

**Nokia Customer Care**

# ***Service Manual***

**RM-274 (Nokia 3109c)**  
**Mobile Terminal**  
*Part No: 9203402 (Issue 1)*

***COMPANY CONFIDENTIAL***



**Amendment Record Sheet**

Amendment No	Date	Inserted By	Comments
Issue 1	06/2007	Y Liu	

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The availability of particular products may vary by region.

## IMPORTANT

This document is intended for use by qualified service personnel only.

## Warnings and cautions

### Warnings

- IF THE DEVICE CAN BE INSTALLED IN A VEHICLE, CARE MUST BE TAKEN ON INSTALLATION IN VEHICLES FITTED WITH ELECTRONIC ENGINE MANAGEMENT SYSTEMS AND ANTI-SKID BRAKING SYSTEMS. UNDER CERTAIN FAULT CONDITIONS, EMITTED RF ENERGY CAN AFFECT THEIR OPERATION. IF NECESSARY, CONSULT THE VEHICLE DEALER/MANUFACTURER TO DETERMINE THE IMMUNITY OF VEHICLE ELECTRONIC SYSTEMS TO RF ENERGY.
- THE PRODUCT MUST NOT BE OPERATED IN AREAS LIKELY TO CONTAIN POTENTIALLY EXPLOSIVE ATMOSPHERES, FOR EXAMPLE, PETROL STATIONS (SERVICE STATIONS), BLASTING AREAS ETC.
- OPERATION OF ANY RADIO TRANSMITTING EQUIPMENT, INCLUDING CELLULAR TELEPHONES, MAY INTERFERE WITH THE FUNCTIONALITY OF INADEQUATELY PROTECTED MEDICAL DEVICES. CONSULT A PHYSICIAN OR THE MANUFACTURER OF THE MEDICAL DEVICE IF YOU HAVE ANY QUESTIONS. OTHER ELECTRONIC EQUIPMENT MAY ALSO BE SUBJECT TO INTERFERENCE.
- BEFORE MAKING ANY TEST CONNECTIONS, MAKE SURE YOU HAVE SWITCHED OFF ALL EQUIPMENT.

### Cautions

- Servicing and alignment must be undertaken by qualified personnel only.
- Ensure all work is carried out at an anti-static workstation and that an anti-static wrist strap is worn.
- Ensure solder, wire, or foreign matter does not enter the telephone as damage may result.
- Use only approved components as specified in the parts list.
- Ensure all components, modules, screws and insulators are correctly re-fitted after servicing and alignment.
- Ensure all cables and wires are repositioned correctly.
- During testing never activate the GSM transmitter without a proper antenna load, otherwise the GSM PA may be damaged.



## **For your safety**

### **QUALIFIED SERVICE**

Only qualified personnel may install or repair phone equipment.

### **ACCESSORIES AND BATTERIES**

Use only approved accessories and batteries. Do not connect incompatible products.

### **CONNECTING TO OTHER DEVICES**

When connecting to any other device, read its user's guide for detailed safety instructions. Do not connect incompatible products.

## Care and maintenance

This product is of superior design and craftsmanship and should be treated with care. The suggestions below will help you to fulfil any warranty obligations and to enjoy this product for many years.

- Keep the phone and all its parts and accessories out of the reach of small children.
- Keep the phone dry. Precipitation, humidity and all types of liquids or moisture can contain minerals that will corrode electronic circuits.
- Do not use or store the phone in dusty, dirty areas. Its moving parts can be damaged.
- Do not store the phone in hot areas. High temperatures can shorten the life of electronic devices, damage batteries, and warp or melt certain plastics.
- Do not store the phone in cold areas. When it warms up (to its normal temperature), moisture can form inside, which may damage electronic circuit boards.
- Do not drop, knock or shake the phone. Rough handling can break internal circuit boards.
- Do not use harsh chemicals, cleaning solvents, or strong detergents to clean the phone.
- Do not paint the phone. Paint can clog the moving parts and prevent proper operation.
- Use only the supplied or an approved replacement antenna. Unauthorised antennas, modifications or attachments could damage the phone and may violate regulations governing radio devices.

All of the above suggestions apply equally to the product, battery, charger or any accessory.

## ESD protection

Nokia requires that service points have sufficient ESD protection (against static electricity) when servicing the phone.

Any product of which the covers are removed must be handled with ESD protection. The SIM card can be replaced without ESD protection if the product is otherwise ready for use.

To replace the covers ESD protection must be applied.

All electronic parts of the product are susceptible to ESD. Resistors, too, can be damaged by static electricity discharge.

All ESD sensitive parts must be packed in metallized protective bags during shipping and handling outside any ESD Protected Area (EPA).

Every repair action involving opening the product or handling the product components must be done under ESD protection.

ESD protected spare part packages **MUST NOT** be opened/closed out of an ESD Protected Area.

For more information and local requirements about ESD protection and ESD Protected Area, contact your local Nokia After Market Services representative.

## Battery information

**Note:** A new battery's full performance is achieved only after two or three complete charge and discharge cycles!

The battery can be charged and discharged hundreds of times but it will eventually wear out. When the operating time (talk-time and standby time) is noticeably shorter than normal, it is time to buy a new battery.

Use only batteries approved by the phone manufacturer and recharge the battery only with the chargers approved by the manufacturer. Unplug the charger when not in use. Do not leave the battery connected to a charger for longer than a week, since overcharging may shorten its lifetime. If left unused a fully charged battery will discharge itself over time.

Temperature extremes can affect the ability of your battery to charge.

For good operation times with Ni-Cd/NiMH batteries, discharge the battery from time to time by leaving the product switched on until it turns itself off (or by using the battery discharge facility of any approved accessory available for the product). Do not attempt to discharge the battery by any other means.

Use the battery only for its intended purpose.

Never use any charger or battery which is damaged.

Do not short-circuit the battery. Accidental short-circuiting can occur when a metallic object (coin, clip or pen) causes direct connection of the + and - terminals of the battery (metal strips on the battery) for example when you carry a spare battery in your pocket or purse. Short-circuiting the terminals may damage the battery or the connecting object.

Leaving the battery in hot or cold places, such as in a closed car in summer or winter conditions, will reduce the capacity and lifetime of the battery. Always try to keep the battery between 15°C and 25°C (59°F and 77°F). A phone with a hot or cold battery may temporarily not work, even when the battery is fully charged. Batteries' performance is particularly limited in temperatures well below freezing.

Do not dispose of batteries in a fire!

Dispose of batteries according to local regulations (e.g. recycling). Do not dispose as household waste.

## Company Policy

Our policy is of continuous development; details of all technical modifications will be included with service bulletins.

While every endeavour has been made to ensure the accuracy of this document, some errors may exist. If any errors are found by the reader, NOKIA MOBILE PHONES Business Group should be notified in writing/e-mail.

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## **Nokia 3109c Service Manual Structure**

- 1 General information
- 2 Service Tools and Service Concepts
- 3 BB Troubleshooting and Manual Tuning Guide
- 4 RF Troubleshooting and Manual Tuning Guide
- 5 System module
- Glossary

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# Nokia Customer Care

## 1 — General information

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## ■ Product selection

The RM-274 is class 4 (max 2W) GSM tri-band hand portable phone, supporting GSM 900/1800/1900 band. The RM-274 also supports EGPRS and GPRS (Packed data). It is a class B&C terminal, supporting EGPRS multislot class 10 (4Rx + 1Tx and 3Rx + 2Tx) and GPRS multislot class 10 (4+1, 3+2).

The RM-274 is MMS (Multimedia Messaging Services) version 1.2 enabled phone with 128x160 pixel active matrix display supporting up to 262k colours.

The RM-274 has a 3GPP video player and a music player, and it supports Bluetooth, microSD card and IrDa. The XHTML/WAP browser in RM-274 is compatible with the version 2.0 specifications and it supports HTTP/TCP/IP stack.

In addition the RM-274 is a Java-enabled phone (Java™ 2 Platform, Micro Edition, for embedded devices). It supports MIDP Java 2.0 with additional APIs.

The supported user interface is S40, that is, RM-274 software is based on the ISA platform.



Figure 1 RM-274 product picture

## ■ Display and keypad features

- Main display: Active matrix display supporting up to 262k colors (128 x 160 pixels, 28.4 mm x 35.5 mm active area)
- Power switch
- Side volume keys

## ■ Features

### Hardware features

- Monoblock phone

- 10MB physical internal user memory
- µSD memory card slot (up to 2GB)
- Music player
- Integrated handsfree speaker
- Internal vibra
- Bluetooth
- 2.0 mm DC charger plug
- Mini-USB connector
- 2.5mm Nokia AV connector

### Software features

- ISA OS 8.0s Platform
- Nokia Series 40 User interface (UI): Java™ MIDP 2.0

### UI features

Imaging	<ul style="list-style-type: none"> <li>• Full-screen view finder</li> <li>• PictBridge printing via USB cable</li> <li>• Multimedia contents can be sent via MMS</li> </ul>
Multimedia	<ul style="list-style-type: none"> <li>• MP3 player supporting formats including MP3, Midi, AAC, AAC+, enhanced AAC+, WMA</li> <li>• Music player</li> <li>• 3GPP video player</li> <li>• MP3 ringing tones, True tones and MIDI tones, with support of 64 polyphony</li> </ul>
Memory functions	<ul style="list-style-type: none"> <li>• Combo memory with 32 MB flash and 16 MB RAM – about 10 MB physical internal user memory (for gallery and applications, contacts, notes, calendar entries)</li> </ul>
Messaging	<ul style="list-style-type: none"> <li>• Simplified messaging with recently used contacts log and groups</li> <li>• Email: Access your work and private email accounts; supports SMTP, POP3, and IMAP4 protocols. Support for attachments (Java version)</li> <li>• Audio messaging service (AMS): Record your own voice message and send to compatible devices</li> <li>• MMS OMA 1.2: Combine image, video, text, and voice clips and send as an MMS to a compatible phone or PC; use MMS to tell your story with a multi-slide presentation. The MMS OMA 1.2 specification allows you to send/receive messages up to 300 kB in size.</li> <li>• Text messaging: Supports concatenated SMS, picture messaging, SMS distribution list</li> <li>• Predictive text input: Support for all major languages in Europe and Asia-Pacific</li> <li>• Instant Messaging (IM)</li> </ul>

Applications	<ul style="list-style-type: none"> <li>• Java™ MIDP 2.0 with over-the-air download</li> <li>• Pre-installed Java™-based applications and games</li> <li>• SIM Application Toolkit</li> <li>• Wireless Presenter</li> </ul>
Connectivity	<ul style="list-style-type: none"> <li>• Nokia PC Suite with USB, Bluetooth and Infrared connectivity</li> <li>• SIM access profile and handsfree profile</li> <li>• Nokia AV connector interface with USB</li> <li>• Active standby</li> <li>• FOTA (Flashing over-the-air)</li> <li>• Local/remote SyncML data synchronization</li> <li>• E-mail client with support for attachments</li> </ul>
Browsing	<ul style="list-style-type: none"> <li>• Integrated XHTML browser</li> <li>• Smart content download - OMA DRM 2.0</li> </ul>
Data transfer	<ul style="list-style-type: none"> <li>• EDGE (EGPRS): Class 10, download up to 236.8 kbps</li> <li>• GPRS: Class 10, download up to 53.6 kbps</li> <li>• <b>Note:</b> Actual achieved speeds may vary depending on network support</li> <li>• GPRS/EDGE/HSCSD/CSD for browsing and as data modem</li> <li>• Downlink Advanced Receiver Performance (DARF)</li> </ul>
Voice features	<ul style="list-style-type: none"> <li>• Enhanced voice dialling with SIND: Speaker-independent name dialling for easy call handling</li> <li>• Integrated handsfree speaker with a new high quality speaker for better audio experience (stereo widening effects when attaching the headset)</li> <li>• Voice commands</li> <li>• Voice recorder</li> </ul>
Digital services	<ul style="list-style-type: none"> <li>• User Interface (UI) themes including e.g. animated wallpapers, screensavers, color schemes, ringing tones</li> <li>• Ringing tones: Video, MP3 ringing tones, True Tones and MIDI ringing, alert, and gaming tones with support of 64 polyphonies</li> <li>• OTA download possibility for: Themes, True Tones, MP3 ringing tones, MIDI ringing tones, screensavers, wallpapers, 3GPP streaming, images and videos, Series 40 Java games and applications</li> </ul>
Personal information management (PIM)	<ul style="list-style-type: none"> <li>• Organizer with alarm clock, calendar, to-do list, notes, calculator, countdown timer, and stopwatch</li> <li>• Manage your time and information with the enhanced calendar that can be synchronized, for example, with Microsoft and Lotus PIM application calendars by using the Nokia PC Suite</li> </ul>
Call management	<ul style="list-style-type: none"> <li>• Speed dialling</li> <li>• Speaker independent number/name dialing for easy call handling</li> <li>• Logs: Keeps lists of your dialled, received, and missed calls</li> <li>• Automatic answer (works with headset or car kit only)</li> <li>• Call waiting, call hold, call divert, call timer</li> </ul>

## Mobile enhancements

### Mobile enhancements for RM-274

Table 1 Power

Type	Name
<b>Note:</b> This phone is charged through the smaller Nokia standard interface (2.0 mm plug). The 3.5 mm standard charger can be used together with the CA-44 charger adapter.	
AC-3/AC-5	Compact charger
AC-4	Travel charger
BL-5C	Battery 1020 mAh Li-Ion
CA-44	Charger adapter (from 3.5 mm -> 2 mm)

Table 2 Car

Type	Name
CK-1W	Wireless car kit
CK-7W	Basic universal car kit
CK-20W	Car Installation Kit
CR-39	Universal holder
DC-4	Mobile charger
HF-35W	Wireless Car Handsfree
N616	Car phone

Table 3 Audio

Type	Name
AD-42W	Wireless audio gateway
HS-40	Mono headset
HS-16, HS-42, HS-47	Stereo headsets
HS-44	Wired headset
BH-300, BH-601, BH-700, BH-800, BH-900, HS-4W, HS-50W	Wireless mono headsets



Type	Name
HS-21W, HS-24W, HS-25W, HS-26W, HS-34W, HS-36W, HS-37W, HS-57W, HS-58W	Wireless stereo headsets

Table 4 Data

Type	Name
DKE-2	Mini USB connectivity cable
MU-22	1 GB µSD card
MU-26	128 MB µSD card
MU-27	256 MB µSD card
MU-28	512 MB µSD card
MU-37	2 GB µSD card

## ■ Technical specifications

### General specifications

Unit	Dimension (mm)	Weight (g)	Volume (cc)
Transceiver with BL-5C 1020 mAh Li-Ion battery pack	108,5 x 45,7 x 15,6	87	72

### Battery endurance

Battery	Talk time	Standby time	Music time
BL-5C 1020 mAh Li-ion	4-4.5 hours	Up to 350 hours	> 12 hours

**Note:** Variation in operation times will occur depending on SIM card, network settings and usage. Talk time is increased by up to 30% if half rate is active, and reduced by 5% if enhanced full rate is active.

### Environmental conditions

#### Temperature

Temperature range	Min °C	Max °C
Operational (all specs met)	-5	+55

Temperature range	Min °C	Max °C
Functional (reduced performance)	-30	+70
Storage	-30	+85

The HW module complies with the SPR4 Operating Conditions.

## Humidity

Relative humidity range is 5...95%.

The hardware module is not protected against water. Condensed or splashed water might cause malfunction. Any submerge of the phone will cause permanent damage. Long-term high humidity, with condensation, will cause permanent damage because of corrosion.

The hardware module complies with the SPR4 Operating Conditions.

## Electrical characteristics

Table 5 Normal and extreme voltages

Voltage	Voltage (V)	Condition
General conditions		
Nominal voltage	3.7	
Lower extreme voltage	3.06	a
Higher extreme voltage	4.2	b

a. ADC settings in the SW might shutdown the phone above this value.

b. During fast charging of an empty battery, this voltage might exceed this value. Voltages between 4.20 and 4.60 might appear for a short while.

## **2 — Service Tools and Service Concepts**

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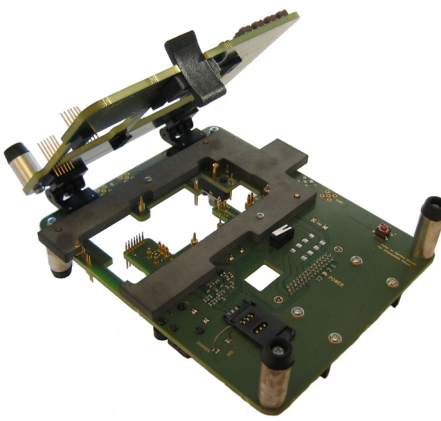

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## ■ Service tools


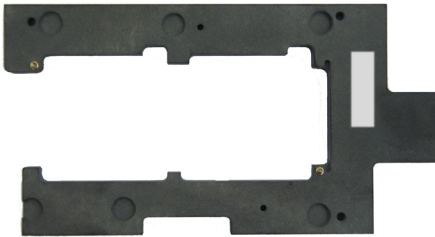
### Product specific tools

The table below gives a short overview of service tools that can be used for testing, error analysis and repair of product RM-274, refer to various concepts.

	FS-47	Flash adapter	
	MJ-122	Module jig	
	RJ-148	Soldering jig	

<p>For flashing (also dead phones) with SS-64. RF testing and tuning, and EM calibration on ATO level with SS-62 (mechanical locking concept), CU-4 supported.</p>																							
<p>MJ-122 is meant for troubleshooting, testing, tuning and flashing on the engine level (CU-4 supported). It can only be used in conjunction with the SS-116 adapter.</p> <p>The jig includes an RF interface for GSM and Bluetooth.</p> <p>The following table shows the attenuation values for galvanic RF connection:</p> <ul style="list-style-type: none"> <li> <table border="1"> <thead> <tr> <th>Band</th><th>Tuning channel</th><th>Attenuation RX</th><th>Attenuation TX</th></tr> </thead> <tbody> <tr> <td>GSM850</td><td>190</td><td>0,1</td><td>0,1</td></tr> <tr> <td>GSM900</td><td>37</td><td>0,1</td><td>0,1</td></tr> <tr> <td>GSM1800</td><td>700</td><td>0,15</td><td>0,15</td></tr> <tr> <td>GSM1900</td><td>661</td><td>0,15</td><td>0,15</td></tr> </tbody> </table> </li> </ul>				Band	Tuning channel	Attenuation RX	Attenuation TX	GSM850	190	0,1	0,1	GSM900	37	0,1	0,1	GSM1800	700	0,15	0,15	GSM1900	661	0,15	0,15
Band	Tuning channel	Attenuation RX	Attenuation TX																				
GSM850	190	0,1	0,1																				
GSM900	37	0,1	0,1																				
GSM1800	700	0,15	0,15																				
GSM1900	661	0,15	0,15																				
<p>RJ-148 is a soldering jig used for soldering and as a rework jig for the engine module.</p>																							

	SA-123	RF coupler	
	SS-116	adaptor frame	

SA-123 is an RF coupler for GSM RF testing. It is used together with the product-specific flash adapter.

The following table shows attenuations from the antenna pads of the mobile terminal to the SMA connectors of SA-123:

• **Nokia 3109c (RM-274)**

Band	Channel	RX Att. (dB)	Tolerance RX	TX Att. (dB)	Tolerance TX
EGSM 900	Low	3	+/-1	4.2	+/-1
	Mid	4		3.5	
	High	5		4	
GSM 1800	Low	3	+/-1	4.4	+/-1
	Mid	3		4.3	
	High	4		3.5	
GSM 1900	Low	3	+/-1	4.5	+/-1
	Mid	4		4.5	
	High	4		5	


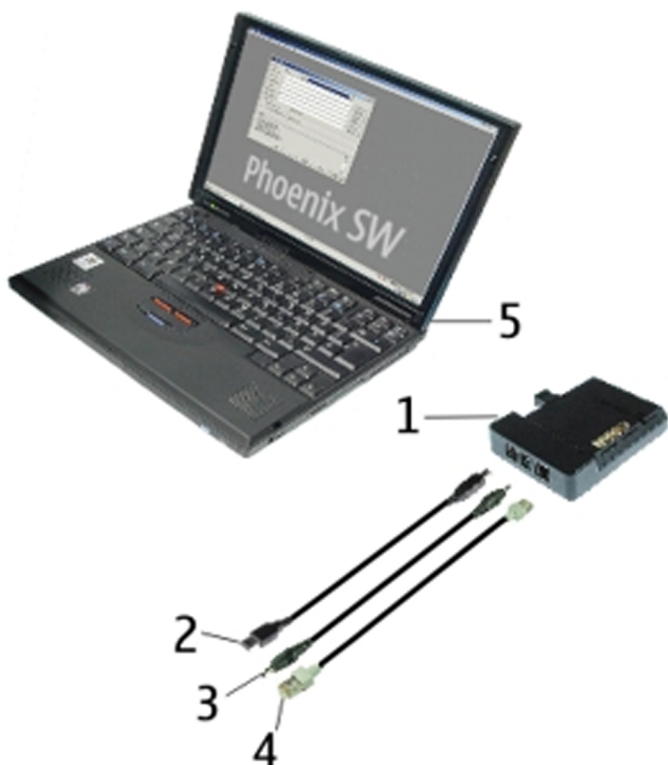
SS-116 Adaptor frame is used with MJ-122 Module Jig.




The Module Jig MJ-122 is delivered with an adaptor frame for use with RM-217 and RM-222. The Guiding pins are in different positions for RM-237 and RM-274. Each adaptor frame is marked according to the transceiver type that it can be used with. Remove the existing adaptor frame and replace with SS-116 to enable MJ-122 re-use with RM-237 and RM-274 phones."




## General tools




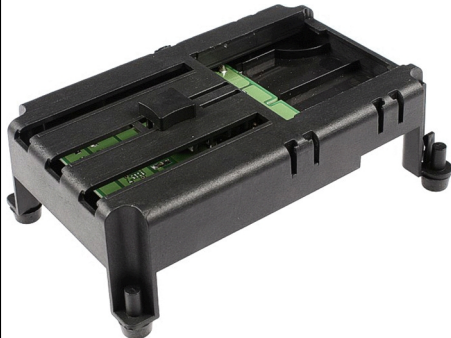
The table below gives a short overview of service tools that can be used for testing, error analysis and repair of product RM-274, refer to various concepts.

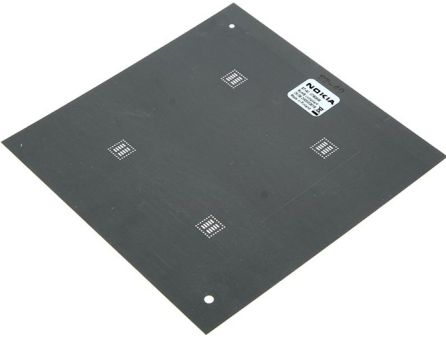



	CU-4	Control unit	
	<p>CU-4 is a general service tool used with a module jig and/or a flash adapter. It requires an external 12 V power supply.</p> <p>The unit has the following features:</p> <ul style="list-style-type: none"> <li>• software controlled via USB</li> <li>• EM calibration function</li> <li>• Forwards FBUS/Flashbus traffic to/from terminal</li> <li>• Forwards USB traffic to/from terminal</li> <li>• software controlled BSI values</li> <li>• regulated VBATT voltage</li> <li>• 2 x USB2.0 connector (Hub)</li> <li>• FBUS and USB connections supported</li> </ul> <p>When using CU-4, note the special order of connecting cables and other service equipment:</p> <p><b>Instructions</b></p> <ol style="list-style-type: none"> <li>1 Connect a service tool (jig, flash adapter) to CU-4.</li> <li>2 Connect CU-4 to your PC with a USB cable.</li> <li>3 Connect supply voltage (12 V)</li> <li>4 Connect an FBUS cable (if necessary).</li> <li>5 Start Phoenix service software.</li> </ol> <div data-bbox="702 1142 1372 1904">  </div> <p><b>Note:</b> Phoenix enables CU-4 regulators via USB when it is started.</p> <p>Reconnecting the power supply requires a Phoenix restart.</p>		

	FLS-4S	Flash device	
	<p>FLS-4S is a dongle and flash device incorporated into one package, developed specifically for POS use.</p>		
	FLS-5	Flash device	
	<p>FLS-5 is a dongle and flash device incorporated into one package, developed specifically for POS use.</p>		
	FPS-10	Flash prommer	
	<p>FPS-10 interfaces with:</p> <ul style="list-style-type: none"> <li>• PC</li> <li>• Control unit</li> <li>• Flash adapter</li> <li>• Smart card</li> </ul> <p>FPS-10 flash prommer features:</p> <ul style="list-style-type: none"> <li>• Flash functionality for BB5 and DCT-4 terminals</li> <li>• Smart Card reader for SX-2 or SX-4</li> <li>• USB traffic forwarding</li> <li>• USB to FBUS/Flashbus conversion</li> <li>• LAN to FBUS/Flashbus and USB conversion</li> <li>• Vusb output switchable by PC command</li> </ul> <p>FPS-10 sales package includes:</p> <ul style="list-style-type: none"> <li>• FPS-10 prommer</li> <li>• Power Supply with 5 country specific cords</li> <li>• USB cable</li> </ul>		


	JBT-9	Bluetooth test and interface box (sales package)	
		<p>The JBT-9 test box is a generic service device used to perform Bluetooth bit error rate (BER) testing, and establishing cordless FBUS connection via Bluetooth. An ACP-8x charger is needed for BER testing and an AXS-4 cable in case of cordless interface usage testing .</p> <p>Sales package includes:</p> <ul style="list-style-type: none"> <li>• JBT-9 test box</li> <li>• Installation and warranty information</li> </ul>	
	PK-1	Software protection key	
		<p>PK-1 is a hardware protection key with a USB interface. It has the same functionality as the PKD-1 series dongle.</p> <p>PK-1 is meant for use with a PC that does not have a series interface.</p> <p>To use this USB dongle for security service functions please register the dongle in the same way as the PKD-1 series dongle.</p>	
	PKD-1	SW security device	
		<p>SW security device is a piece of hardware enabling the use of the service software when connected to the parallel (LPT) port of the PC. Without the device, it is not possible to use the service software. Printer or any such device can be connected to the PC through the device if needed.</p>	
	RJ-93	Rework jig	
		<p>RJ-93 is used as a rework jig for the engine module.</p> <p>This stencil takes the front end module (FEM) or power amplifier (PA) module for spreading the soldering paste to the component. Must be used together with the ST-40 stencil.</p>	

	SPS-1	Soldering Paste Spreader	
	The SPS-1 allows spreading of solder to the LGA components pads over the rework stencils.		
	SRT-6	Opening tool	
	SRT-6 is used to open phone covers.		
	SS-46	Interface adapter	
	SS-46 acts as an interface adapter between the flash adapter and FPS-10.		
	SS-62	Generic flash adapter base for BB5	
	<ul style="list-style-type: none"> <li>• generic base for flash adapters and couplers</li> <li>• SS-62 equipped with a clip interlock system</li> <li>• provides standardised interface towards Control Unit</li> <li>• provides RF connection using galvanic connector or coupler</li> <li>• multiplexing between USB and FBUS media, controlled by VUSB</li> </ul>		





	ST-40	Rework stencil	
	ST-40 is a rework stencil and used with RJ-93.		
	SX-4	Smart card	
	<p>SX-4 is a BB5 security device used to protect critical features in tuning and testing.</p> <p>SX-4 is also needed together with FPS-10 when DCT-4 phones are flashed.</p>		

## Cables

The table below gives a short overview of service tools that can be used for testing, error analysis and repair of product RM-274, refer to various concepts.

	CA-31D	USB cable	
	The CA-31D USB cable is used to connect FPS-10 or FPS-11 to a PC. It is included in the FPS-10 and FPS-11 sales packages.		



	CA-35S	Power cable	
	DAU-9S	MBUS cable	
	DKE-2	Mini-USB cable	
	PCS-1	Power cable	




CA-35S is a power cable for connecting, for example, the FPS-10 flash prommer to the Point-Of-Sales (POS) flash adapter.

The MBUS cable DAU-9S has a modular connector and is used, for example, between the PC's serial port and module jigs, flash adapters or docking station adapters.

**Note:** Docking station adapters valid for DCT4 products.

USB to mini-USB connector cable.

The PCS-1 power cable (DC) is used with a docking station, a module jig or a control unit to supply a controlled voltage.

	XCS-4	Modular cable	
	XRE-2	Bluetooth cable	
	XRS-6	RF cable	

XCS-4 is a shielded (one specially shielded conductor) modular cable for flashing and service purposes.

The bluetooth cable connects the bluetooth connector of the module jig to the bluetooth test box JBT-9.

The RF cable is used to connect, for example, a module repair jig to the RF measurement equipment.  
SMA to N-Connector approximately 610 mm.

Attenuation for:

- GSM850/900: 0.3+-0.1 dB
- GSM1800/1900: 0.5+-0.1 dB
- WLAN: 0.6+-0.1dB

## ■ Service concepts

### POS (Point of Sale) flash concept

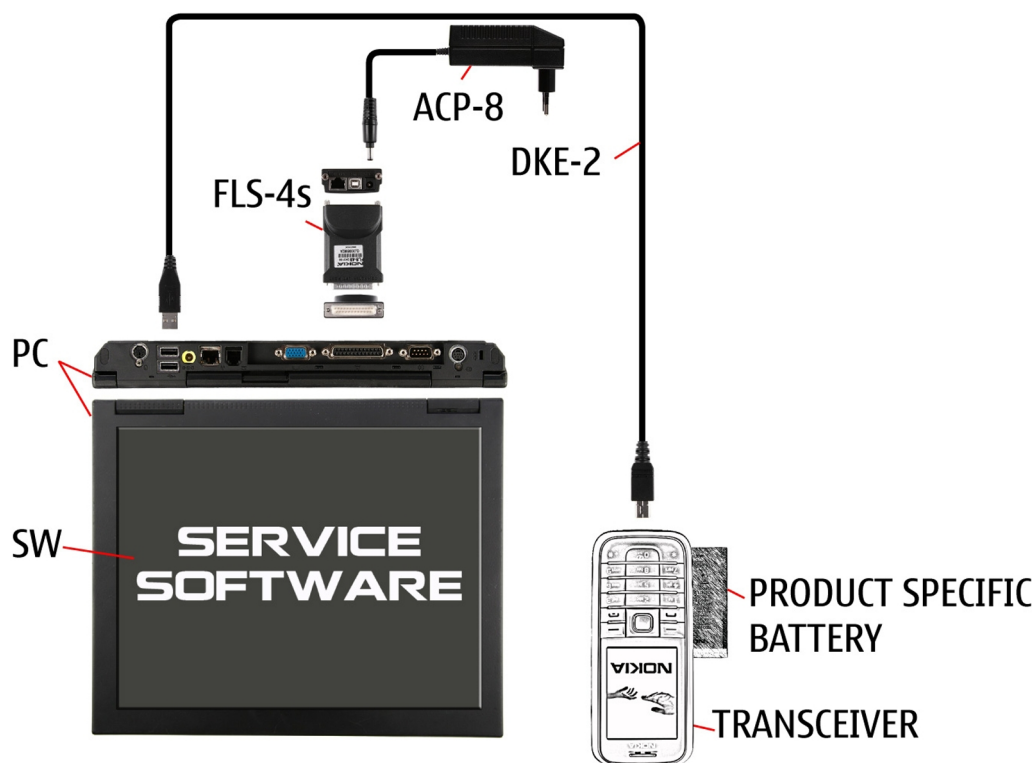


Figure 2 POS flash concept

Type	Description
<b>Product specific devices</b>	
BL-5C	Battery
<b>Other devices</b>	
ACP-8	Power adapter
FLS-4S or FLS-5	POS flash dongle
	PC with Phoenix service software
<b>Cables</b>	
DKE-2	USB connectivity cable



## Flash concept with FPS-10

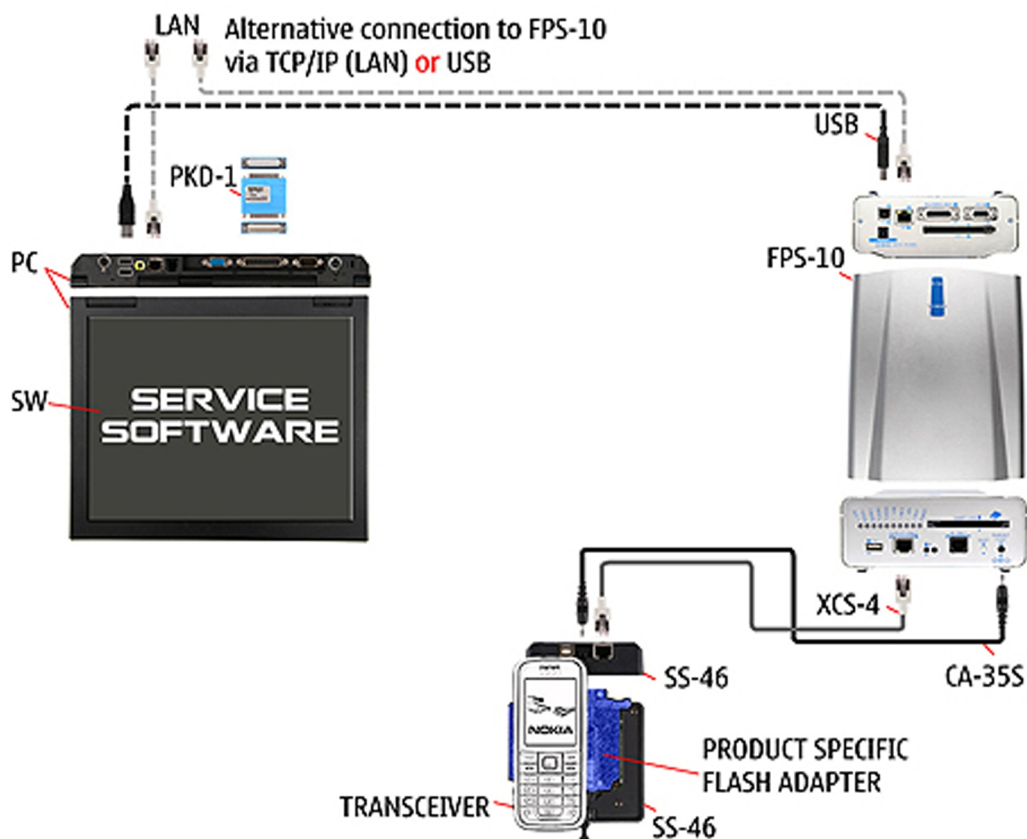


Figure 3 Basic flash concept with FPS-10

Type	Description
<b>Product specific devices</b>	
FS-47	Flash adapter
<b>Other devices</b>	
FPS-10	Flash prommer box
PKD-1/PK-1	SW security device
SS-46	Interface adapter
	PC with Phoenix service software
<b>Cables</b>	
XCS-4	Modular cable
CA-35S	Power cable
	USB cable

# CU-4 flash concept with FPS-10

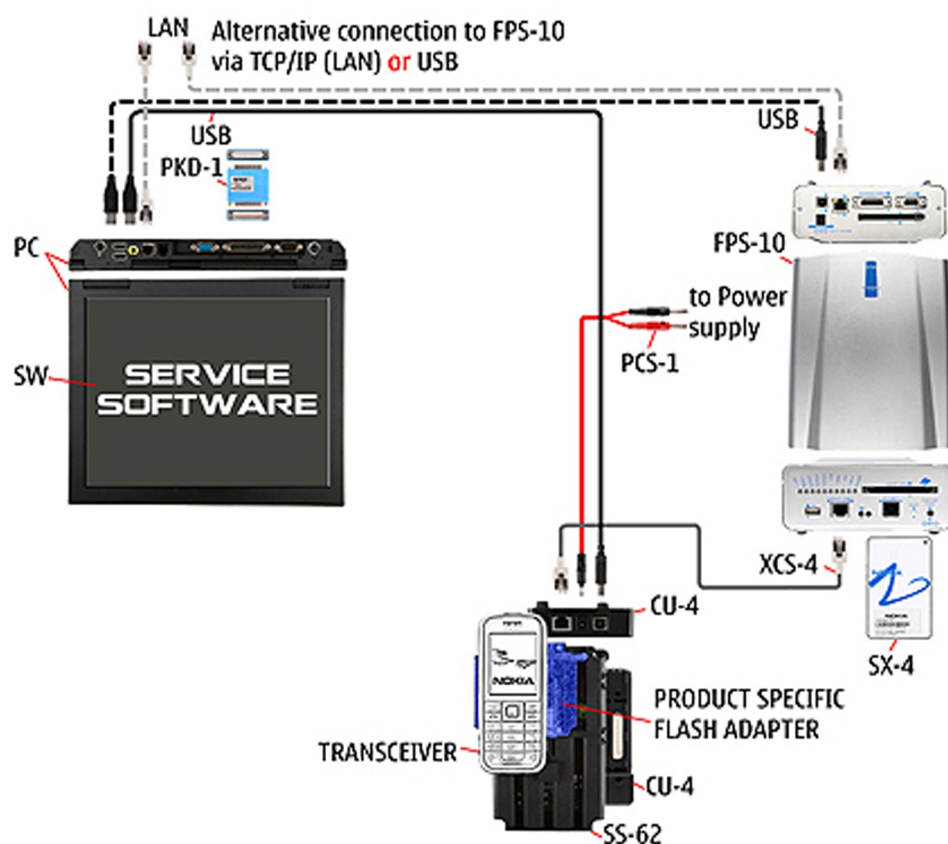


Figure 4 CU-4 flash concept with FPS-10

Type	Description
<b>Product specific devices</b>	
FS-47	Flash adapter
<b>Other devices</b>	
CU-4	Control unit
FPS-10	Flash prommer box
PKD-1/PK-1	SW security device
SS-62	Flash adapter base
SX-4	Smart card
	PC with Phoenix service software
<b>Cables</b>	
PCS-1	Power cable
XCS-4	Modular cable
	Standard USB cable
	USB cable

## Module jig service concept

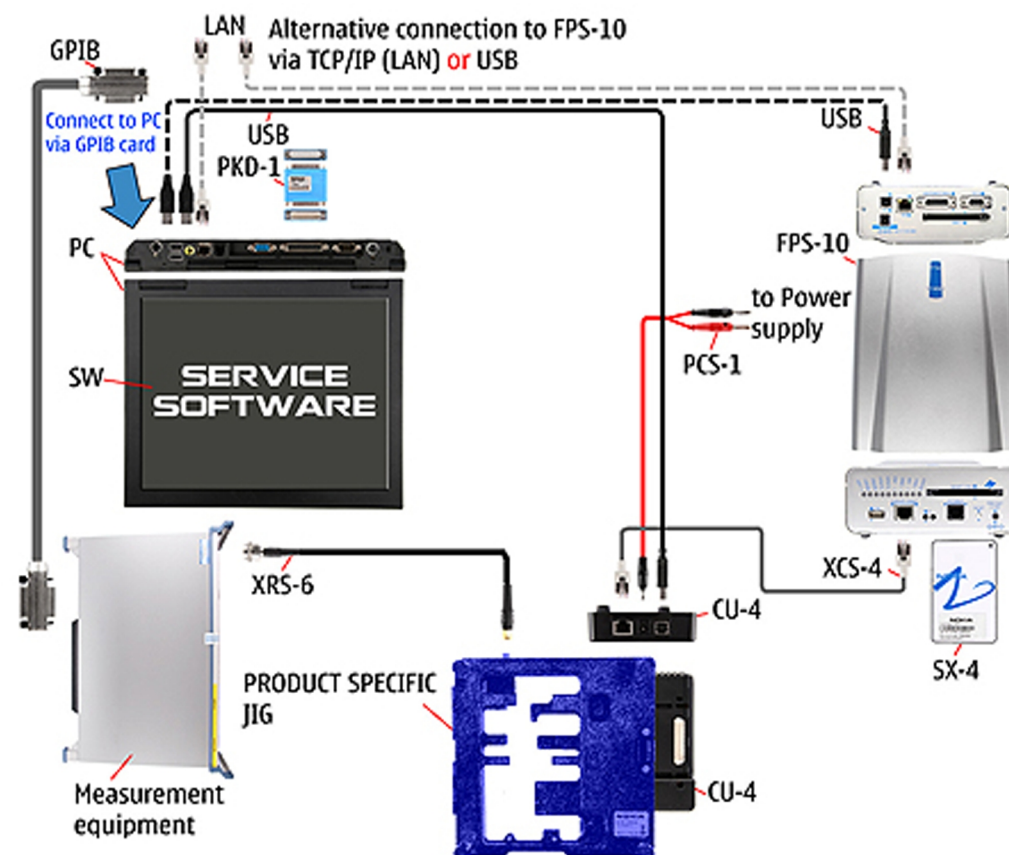


Figure 5 Module jig service concept

Type	Description
<b>Phone specific devices</b>	
MJ-122	Module jig
<b>Other devices</b>	
CU-4	Control unit
FPS-10	Flash prommer box
PKD-1/PK-1	SW security device
SX-4	Smart card
	PC with Phoenix service software
	Measurement equipment
<b>Cables</b>	
PCS-1	DC power cable
XCS-4	Modular cable
XRS-6	RF cable
	USB cable

Type	Description
	GPIB control cable

### RF testing concept with RF coupler

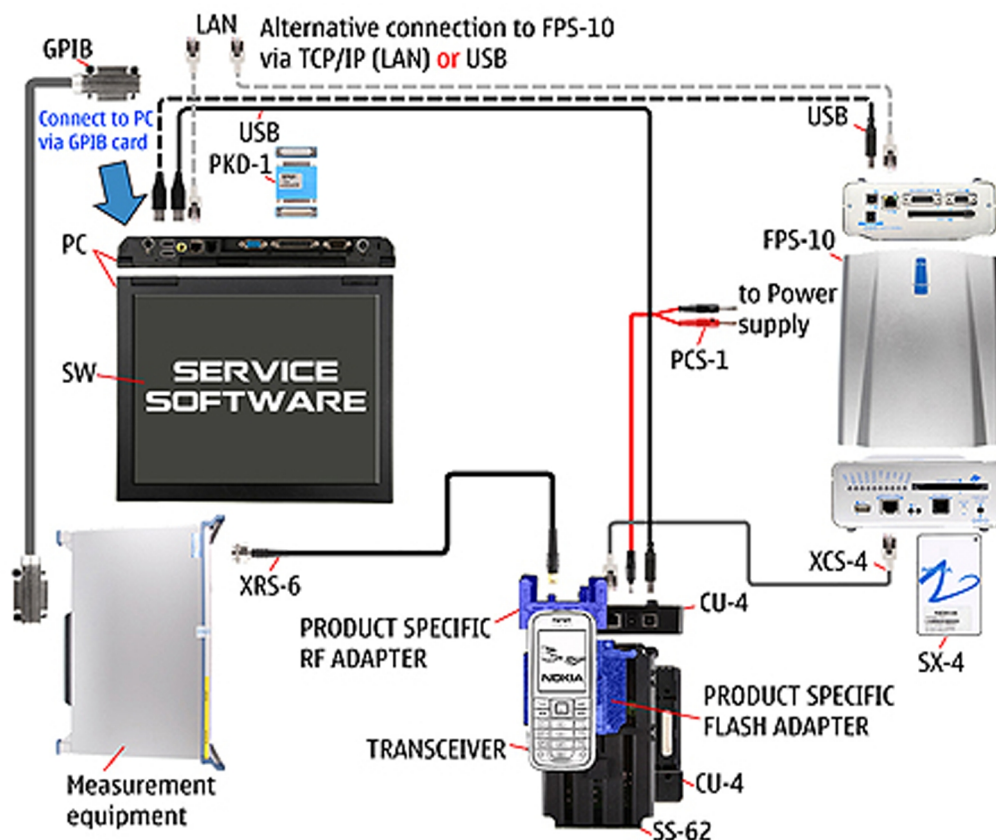


Figure 6 RF testing concept with RF coupler

Type	Description
<b>Product specific devices</b>	
FS-47	Flash adapter
SA-123	RF coupler
<b>Other devices</b>	
CU-4	Control unit
SX-4	Smart card
FPS-10	Flash prommer box
PKD-1/PK-1	SW security device
SS-62	Flash adapter base
	Measurement equipment
	PC with Phoenix service software
<b>Cables</b>	
PCS-1	Power cable

Type	Description
XCS-4	Modular cable
XRS-6	RF cable
	GPIB control cable
	USB cable

### Service concept for RF testing and RF/BB tuning

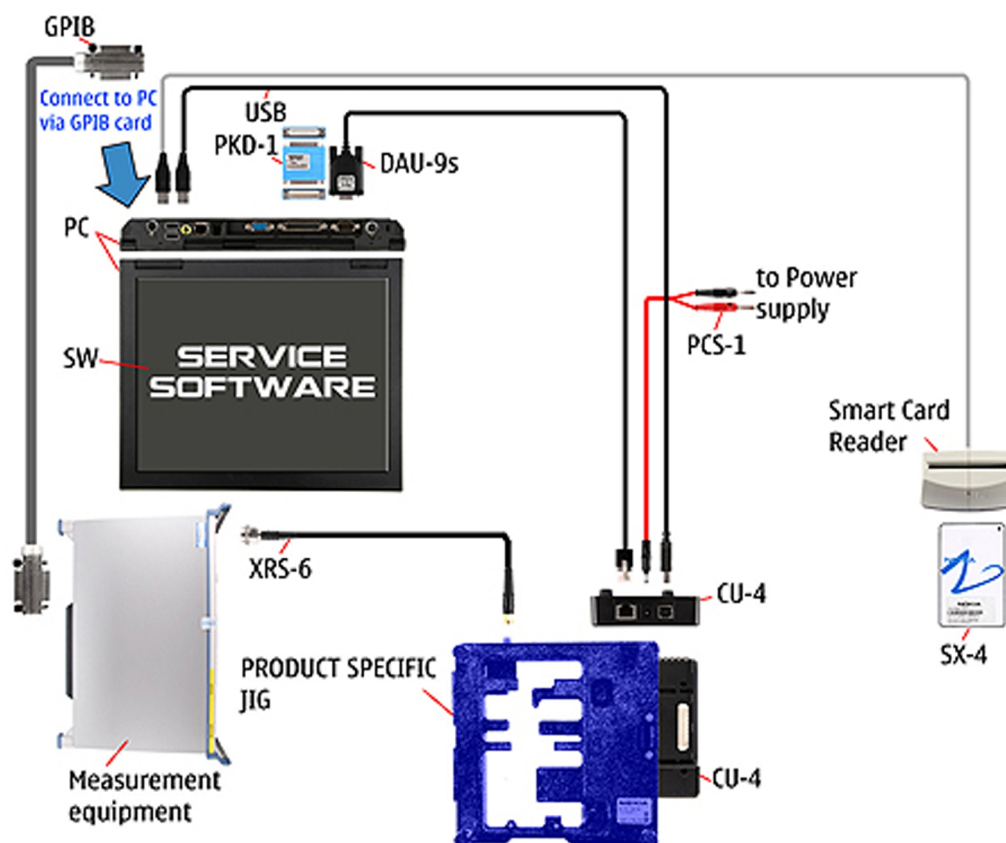


Figure 7 Service concept for RF testing and RF/BB tuning

Type	Description
<b>Product specific devices</b>	
MJ-122	Module jig
<b>Other devices</b>	
CU-4	Control unit
PKD-1/PK-1	SW security device
SX-4	Smart card
	Measurement equipment
	Smart card reader
	PC with Phoenix service software

Type	Description
<b>Cables</b>	
DAU-9s	MBUS cable
PCS-1	DC power cable
XRS-6	RF cable
	GPIB control cable
	USB cable

## **3 — BB Troubleshooting and Manual Tuning Guide**

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## ■ Baseband troubleshooting overview

This section is intended to be a guide for localising and repairing electrical faults.

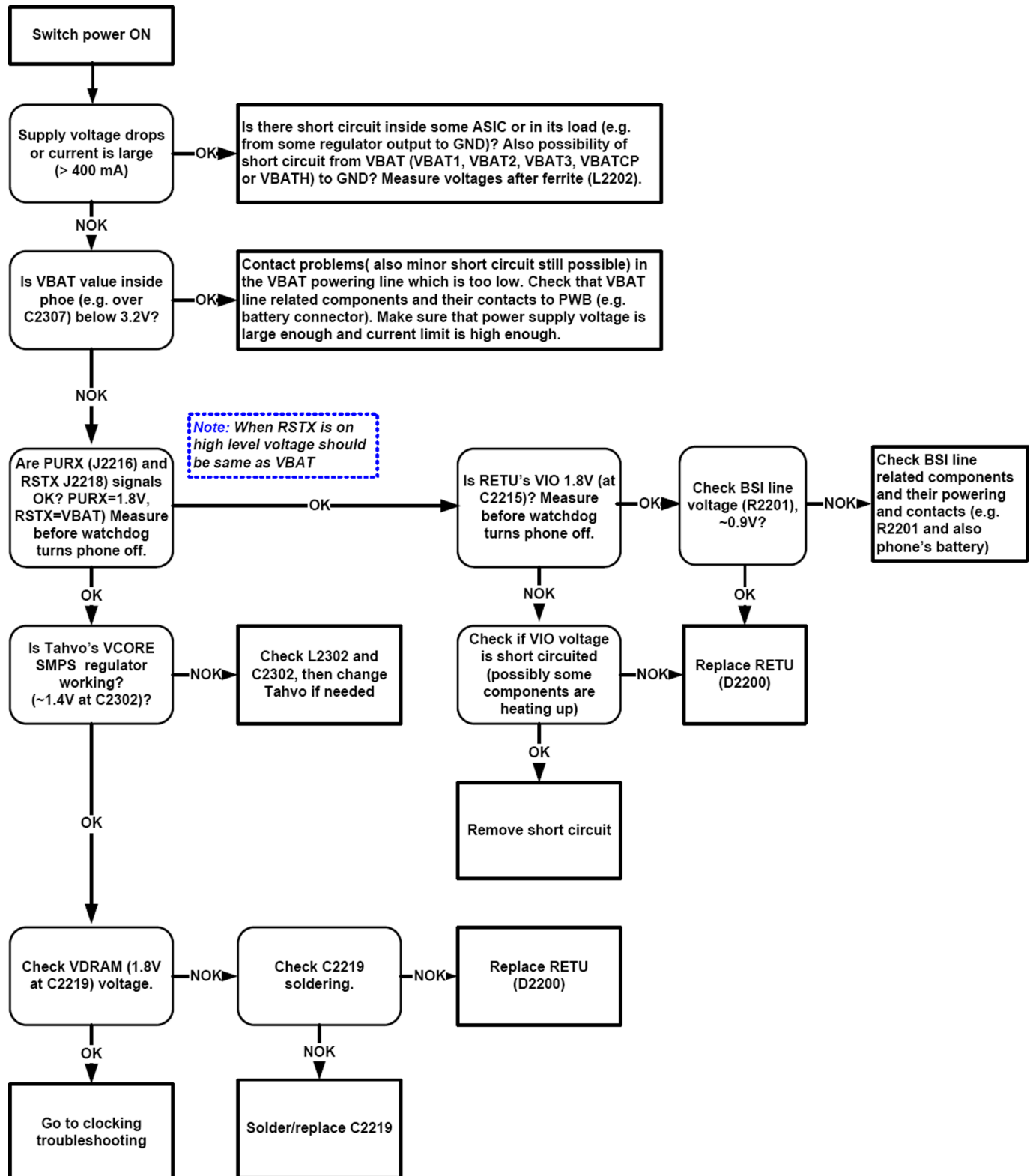
The table below tells you what troubleshooting to go to.

Problem	Troubleshooting
Abnormal current consumption	1 <a href="#">General power checking (page 3-6)</a> 2 <a href="#">Battery current measuring fault (page 3-6)</a>
Flashing does not work or the problem is not clearly defined	1 <a href="#">Flashing (page 3-11)</a> 2 <a href="#">Clocking (page 3-9)</a> 3 <a href="#">Combo memory (page 3-10)</a>
Charging does not work	<a href="#">Charging (page 3-8)</a>
Display does not work	<a href="#">Display fault (page )</a>
Backlights do not work	1 <a href="#">Backlight (page 3-18)</a> 2 <a href="#">LED driver (page 3-19)</a>
USB does not work	<a href="#">USB (page 3-38)</a>
Audio (mic, earpiece, IHF) does not work	1 <a href="#">Audio (page 3-21)</a> 2 <a href="#">Acoustics (page 3-21)</a>
Bluetooth does not work	<a href="#">Bluetooth (BT) (page 3-32)</a>
MicroSD card does not work	<a href="#">MicroSD card (page )</a>
IrDA does not work	<a href="#">IrDA (page 3-20)</a>

## ■ Power and charging troubleshooting

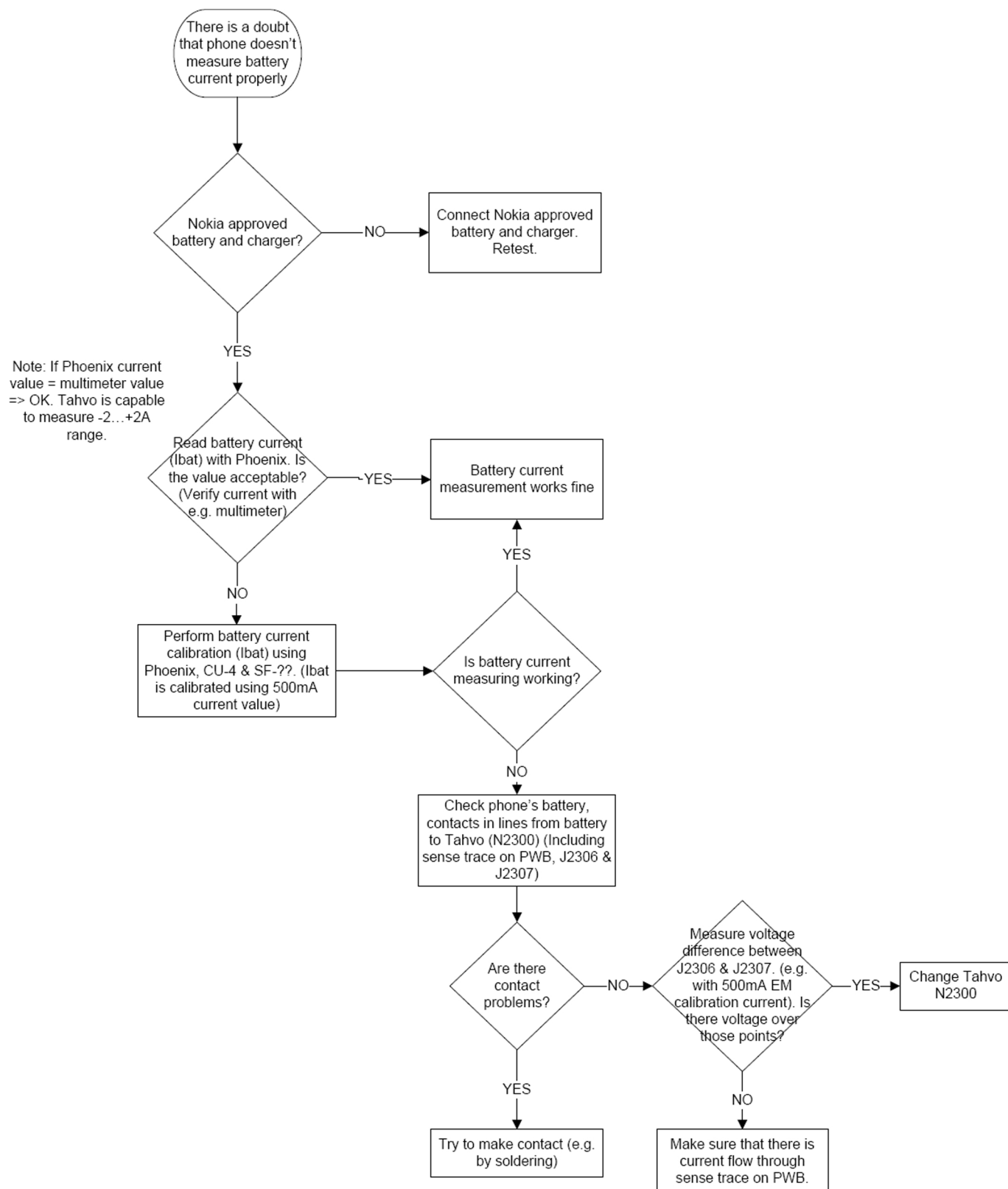
### General power checking troubleshooting

#### Troubleshooting flow



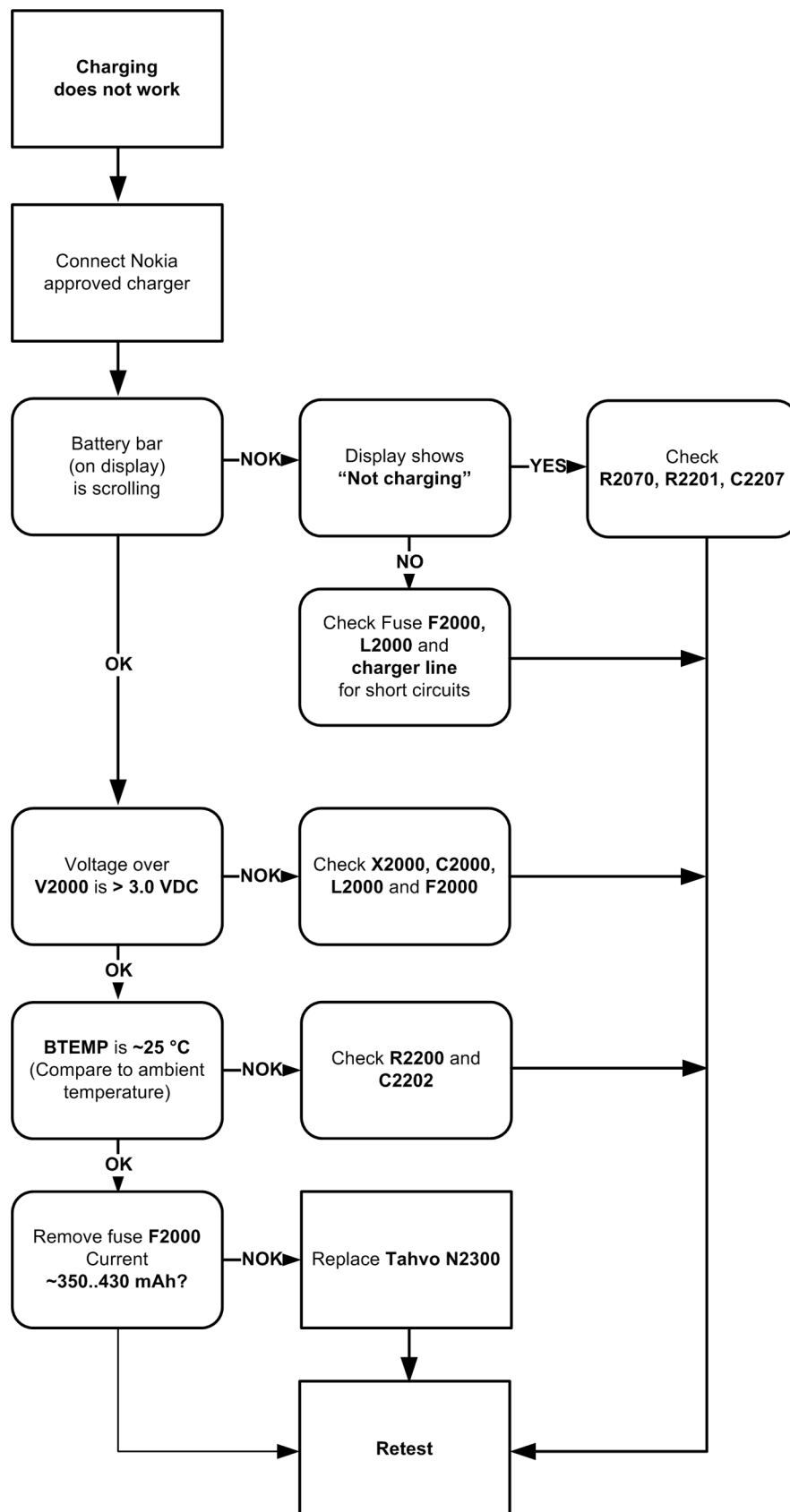
## Battery current measuring fault troubleshooting

### Troubleshooting flow



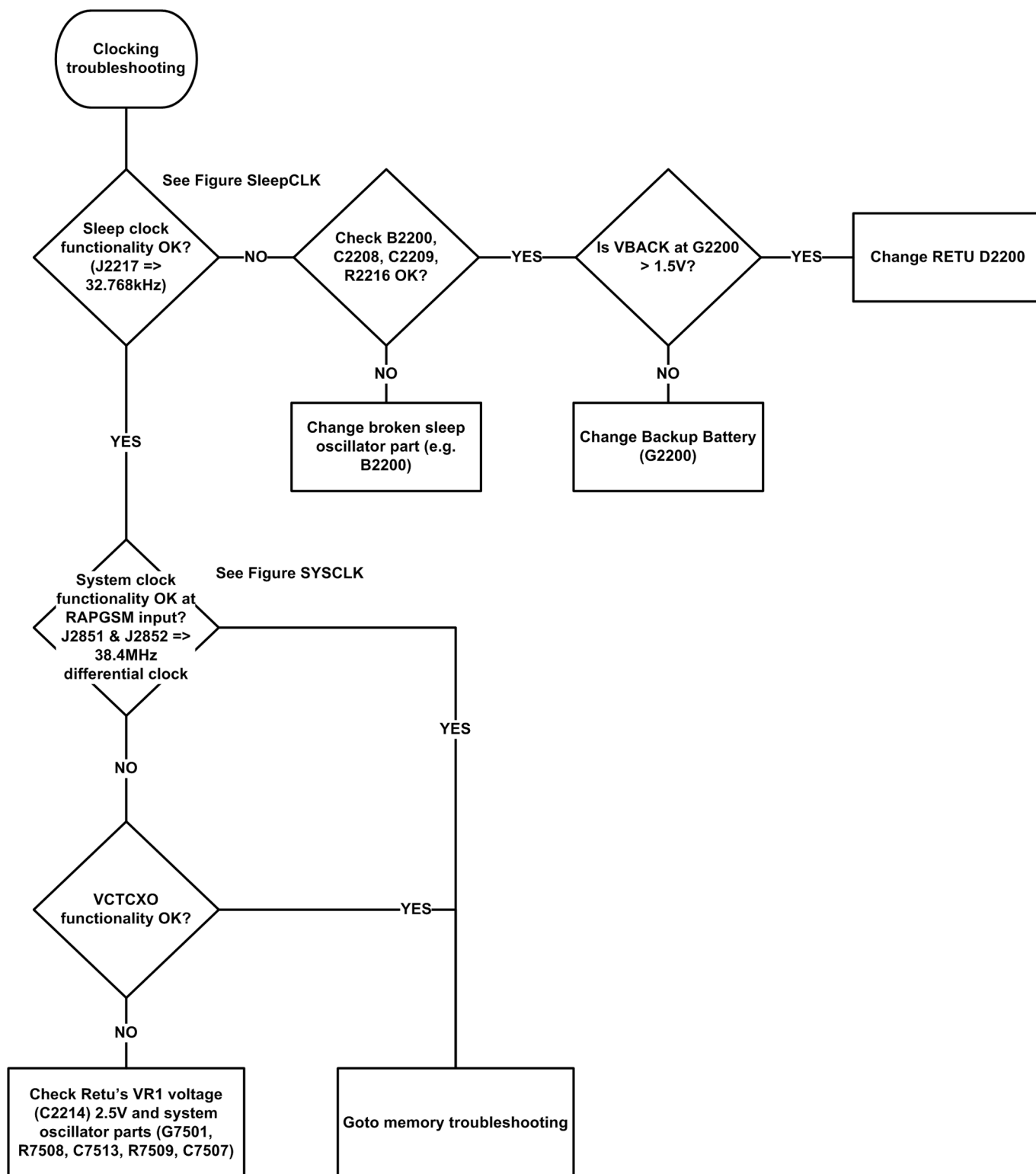
## Charging troubleshooting

### Troubleshooting flow



## Clocking troubleshooting

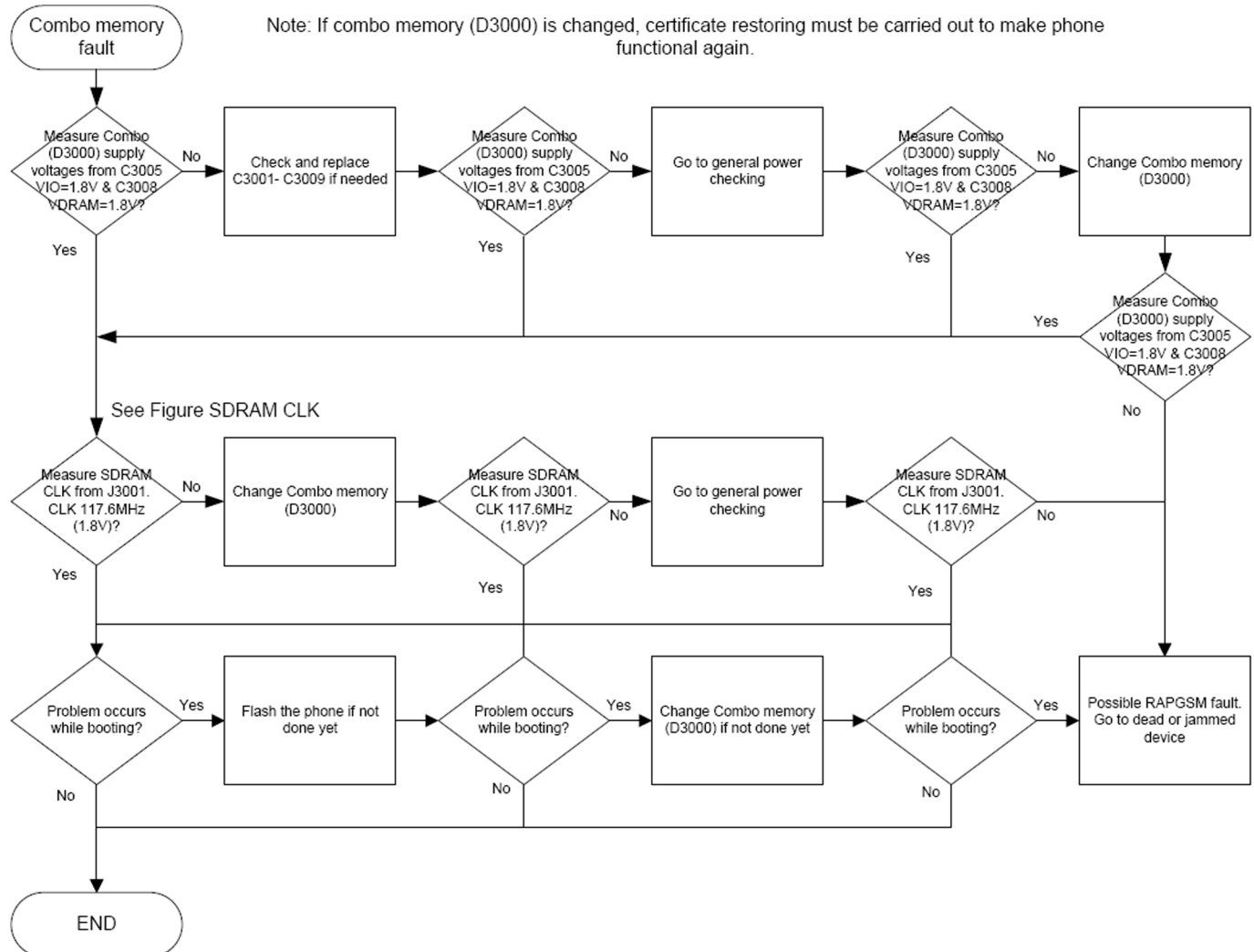
### Troubleshooting flow



## ■ Interface troubleshooting

### COMBO memory troubleshooting

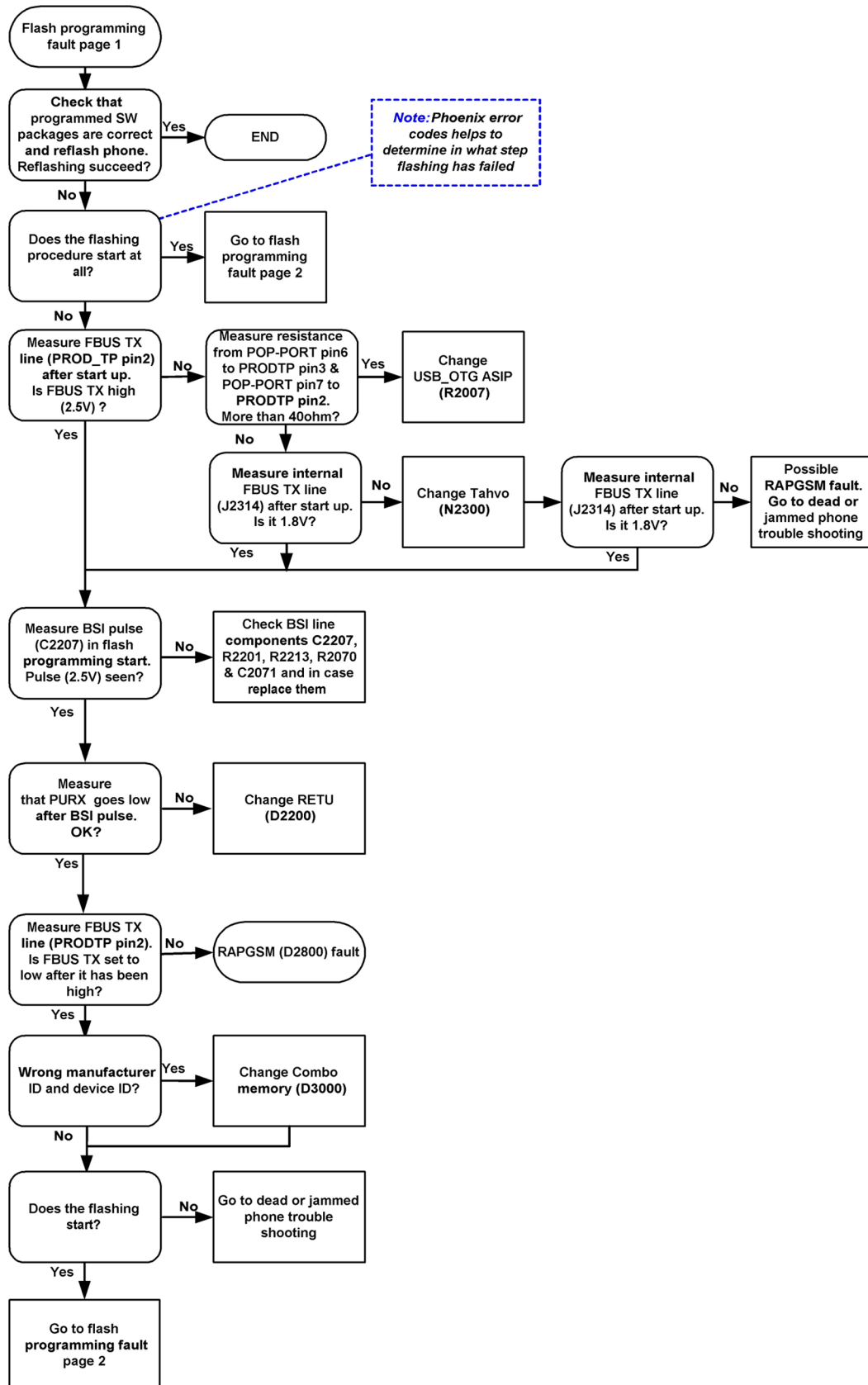
#### Troubleshooting flow



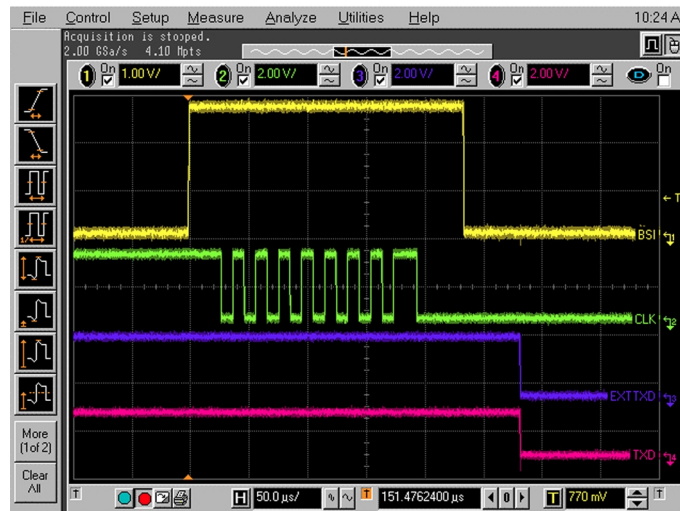


## Flash programming fault troubleshooting

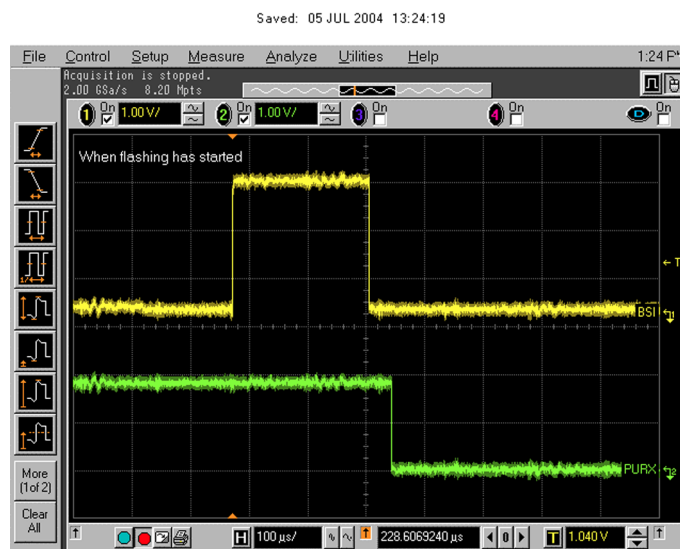
### Part 1



## Part 2



**Figure 8 Flashing pic 1. Take single trig measurement for the rise of the BSI signal.**

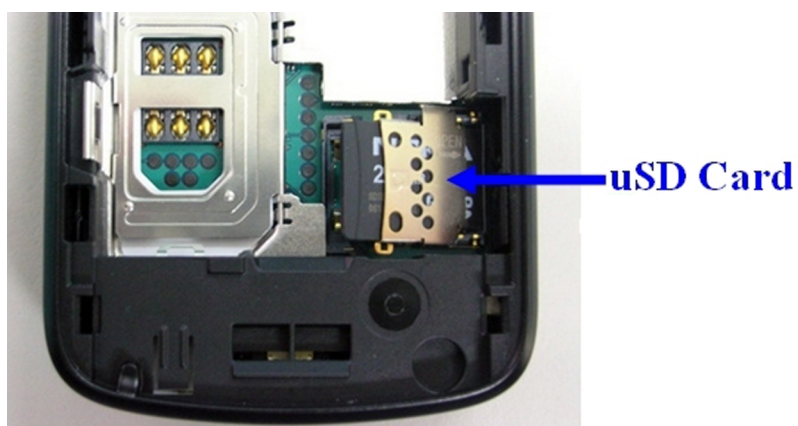


**Figure 9 Flashing pic 2. Take single trig measurement for the rise of the BSI signal.**

## MicroSD card troubleshooting

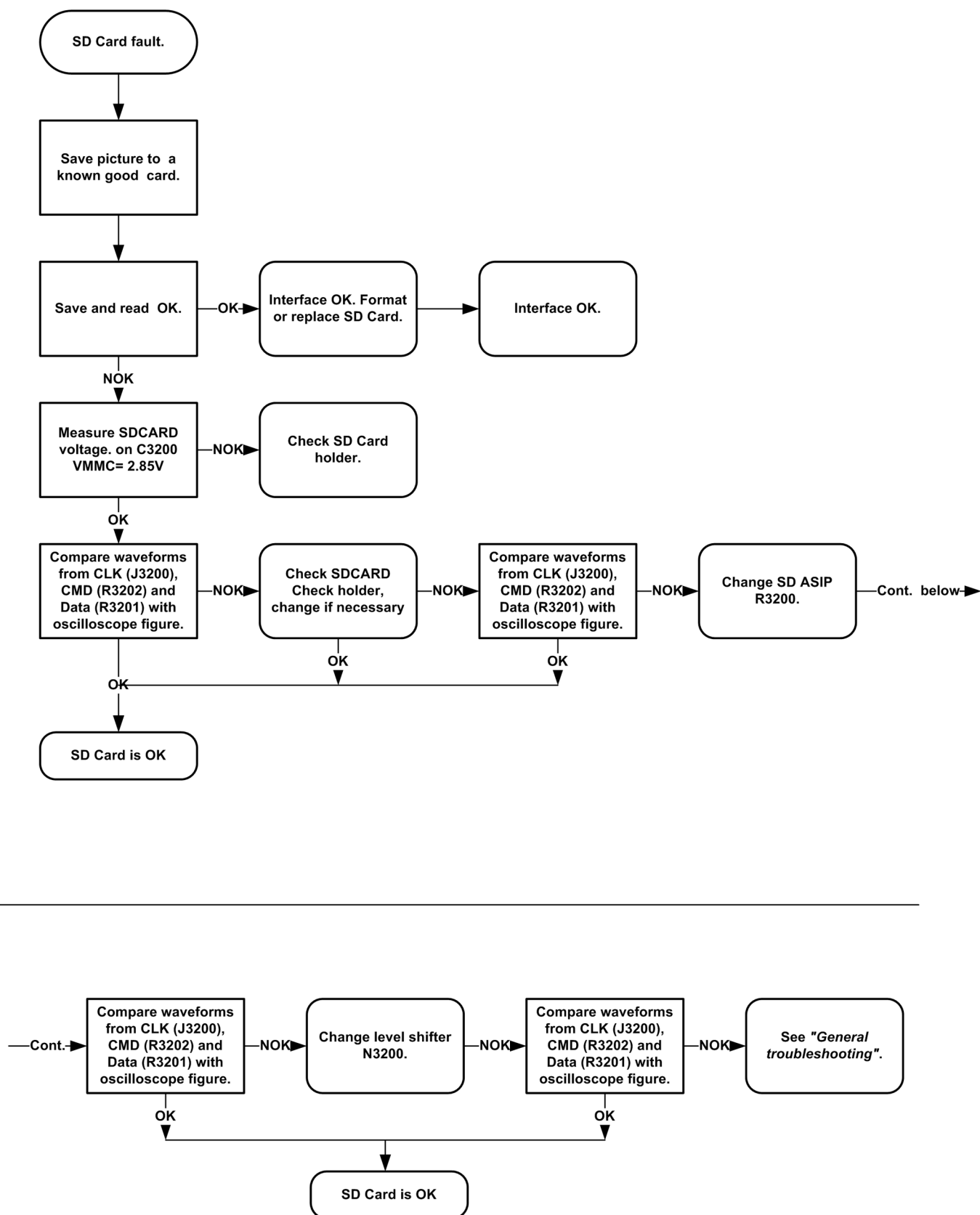
### Context

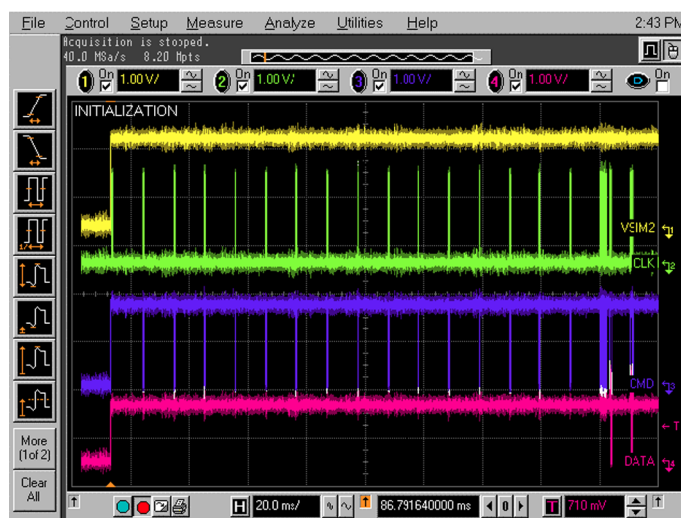
In the RM-274 the microSD card reader is located under the battery cover.



**Figure 10** Location of the microSD card reader in RM-274

## Troubleshooting flow





Take single trig measurement on the rising edge of the DAT signal.

**Figure 11 SD card initialization from pin J3206**

## ■ User interface troubleshooting

### Display module troubleshooting

#### *General instructions for display troubleshooting*

#### Context

The RM-274 has three display modes:

- *Normal mode*: The display is in normal mode when the phone is in active use.
- *Partial idle mode*: The display is in partial idle mode when the power saver is on.
- *Sleep mode*: The display has a sleep mode to conserve power. In this mode the display looks blank, but the phone is switched on. To verify if the phone display is sleeping, press a key.

The operating modes of the display can be controlled with the phone settings menu.

**Table 6 Display module troubleshooting cases**

Display blank	There is no image on the display. The display looks the same when the phone is on as it does when the phone is off. The backlight can be on in some cases.
Image on the display not correct	Image on the display can be corrupted or a part of the image can be missing. If a part of the image is missing, change the display module. If the image is otherwise corrupted, follow the appropriate troubleshooting diagram.
Backlight dim or not working at all	Backlight LED components are inside the display module. Backlight failure can also be in the connector or in the backlight power source in the main engine of the phone.  This means that in case the display is working (image OK), the backlight is faulty.

Visual defects (pixel)	<p>Pixel defects can be checked by controlling the display with Phoenix. Use both colours, black and white, on a full screen.</p> <p>The display may have some random pixel defects that are acceptable for this type of display. The criteria when pixel defects are regarded as a display failure, resulting in a replacement of the display, are presented the following table.</p>
------------------------	--

**Table 7 Pixel defects**

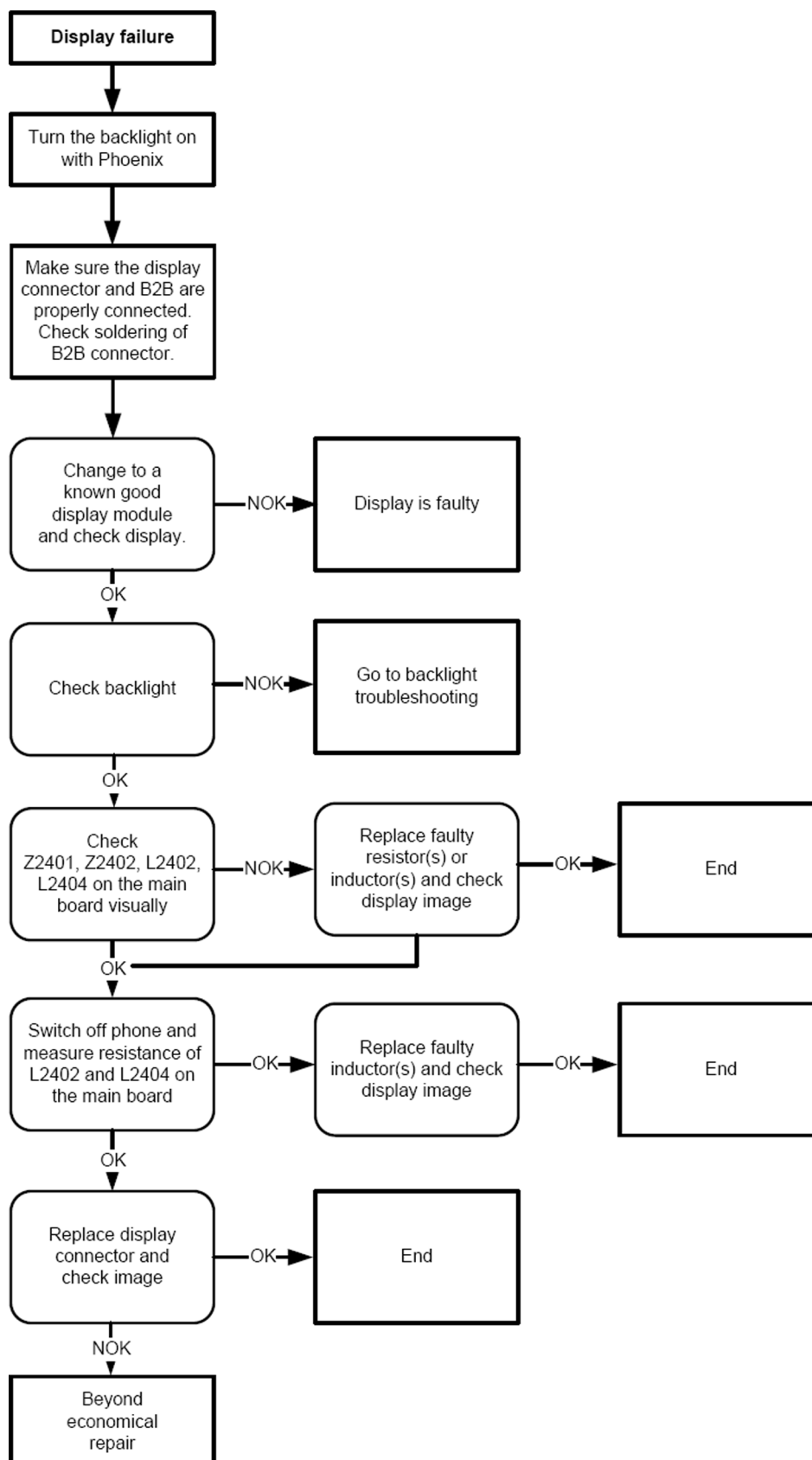
Table 1 - Defect counts							
Item		White dot defect				Black dot defect	Total
1	Defect counts	R	G	B	White Dot Total	1	1
		1	1	1	1		
2	Combined defect counts	Not allowed. Two single dot defects that are within 5 mm of each other should be interpreted as combined dot defect.					

## Steps

1. Verify with a working display that the fault is not on the display module itself.  
The display module cannot be repaired.
2. Check that the cellular engine is working normally.
  - i To check the functionality, connect the phone to a docking station.
  - ii Start *Phoenix* service software.
  - iii Read the phone information to check that also the application engine is functioning normally (you should be able to read the APE ID).
3. Proceed to the display troubleshooting flowcharts.  
Use the **Display Test** tool in *Phoenix* to find the detailed fault mode.

## Display troubleshooting

### Troubleshooting flow

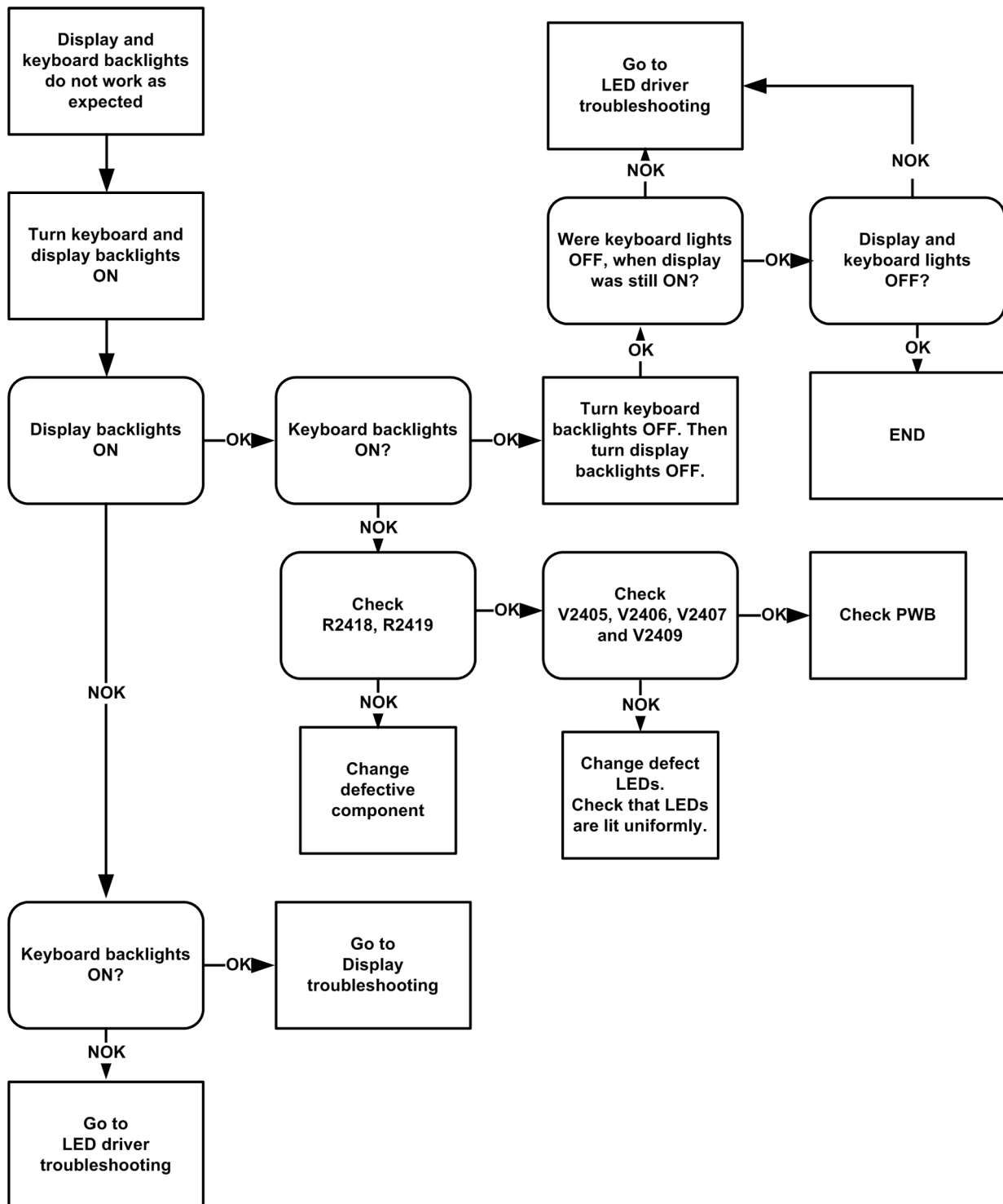


## Backlight troubleshooting

### Context

The device has one LED driver that provides current for both the display and keyboard backlights. Brightness can be adjusted manually, and it affects both the display and keypad. Keyboard backlights can be turned ON/OFF separately but not without switching on the display lights.

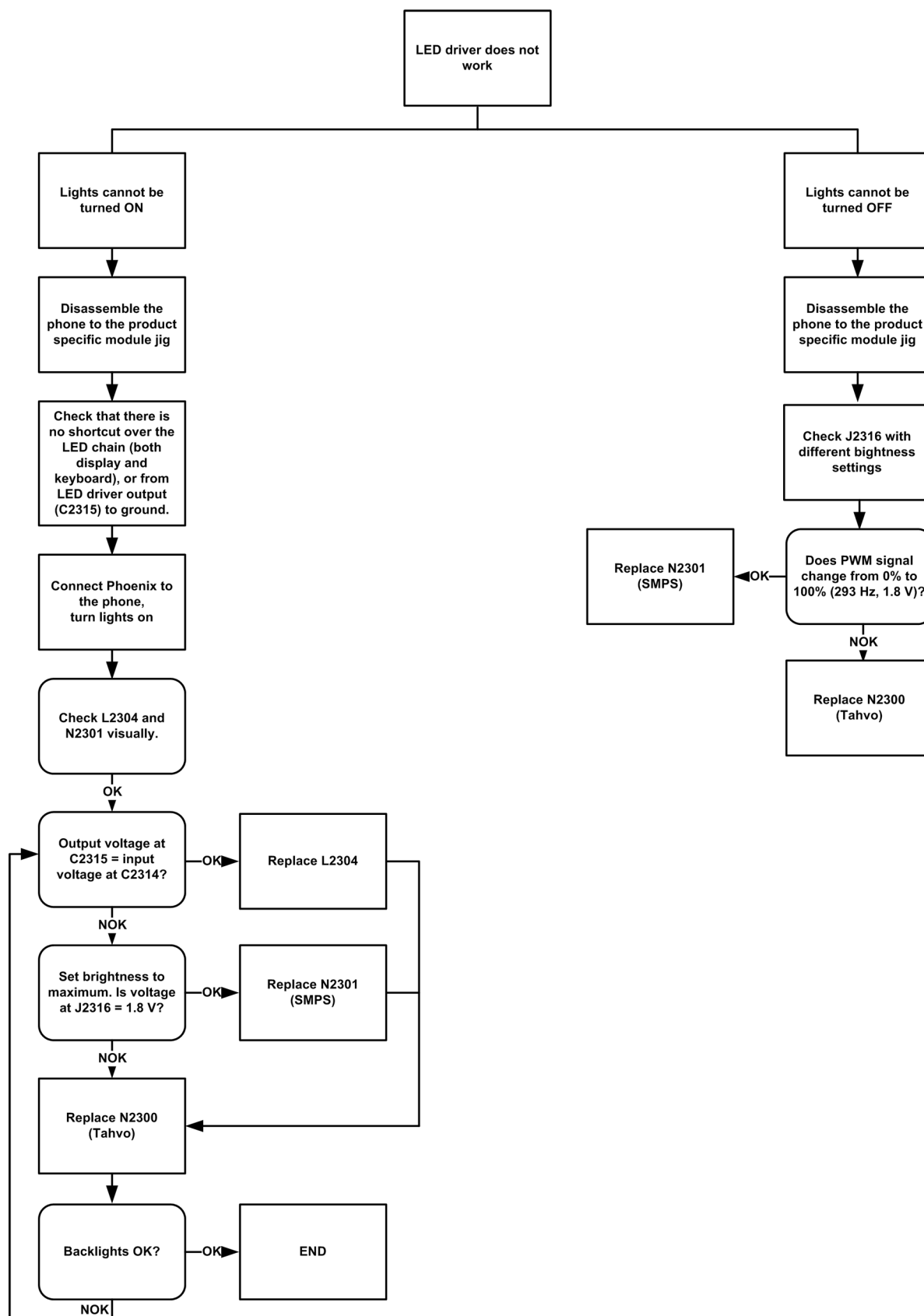
### Display and keyboard backlight troubleshooting





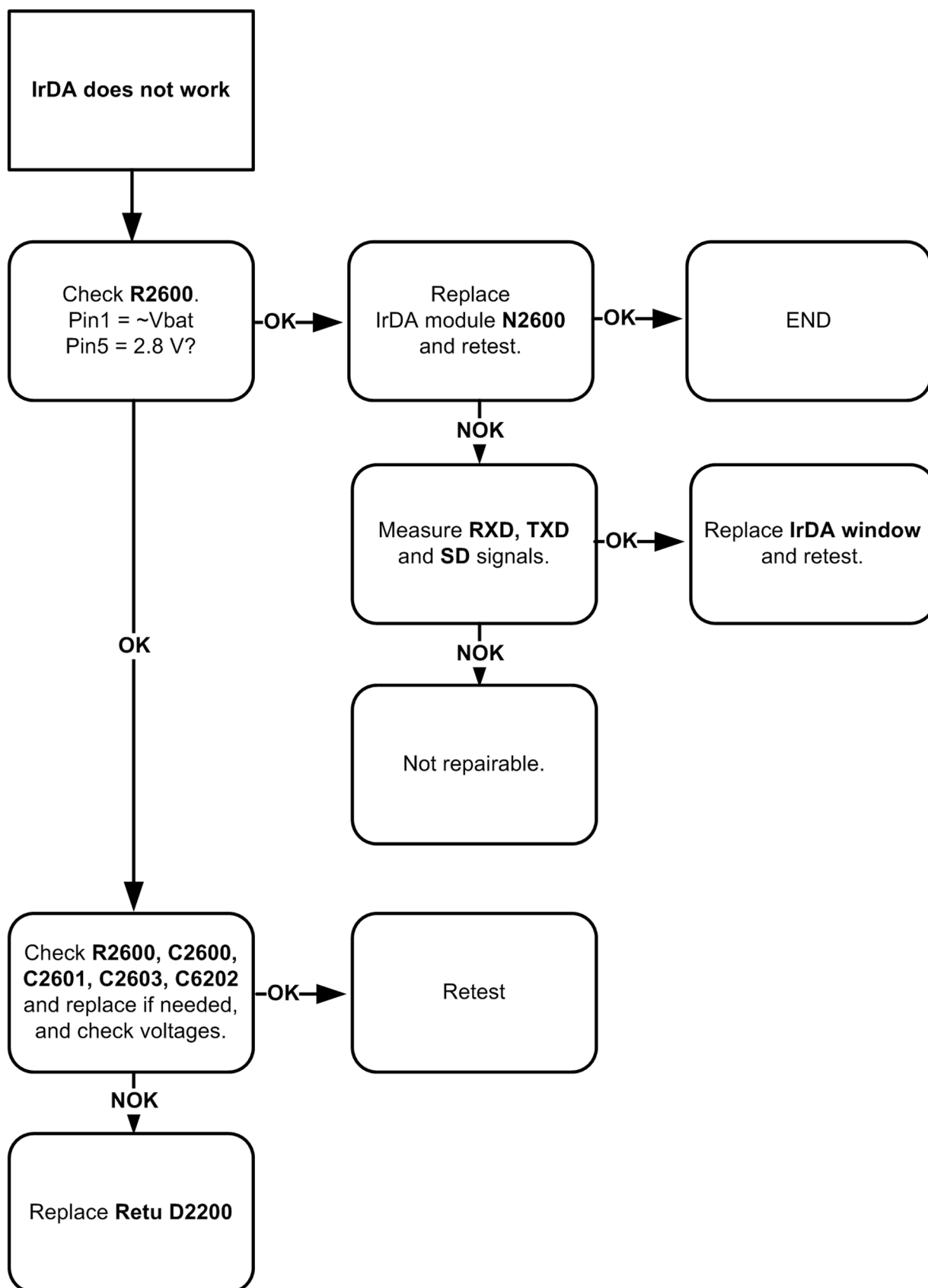
## LED driver troubleshooting

### LED driver troubleshooting



## IrDA troubleshooting

### Troubleshooting flow



## ■ Audio troubleshooting

### Introduction to acoustics troubleshooting

**Note:** Always make sure all openings are clean and all contact pads are intact and make contact. If audio still does not work, please continue to the electronic audio troubleshooting (2nd diagram where applicable).

Acoustics design ensures that the sound is detected correctly with a microphone and properly radiated to the outside of the device by speaker(s). The acoustics of the phone includes three basic systems: earpiece, Integrated Hands Free (IHF) and microphone.

The sound reproduced from the earpiece re radiates through a single hole on the front cover (A-cover). The sound reproduced from the IHF speaker radiates from a single sound hole located 3 cm below the power key. The microphone is located at the hinge, next to the system connector.

For a correct functionality of the phone, all sound holes must be always open. When the phone is used, care must be taken not to close any of those holes with a hand or fingers. The phone should be dry and clean, and no objects must be located in such a way that they close any of the holes.

### Audio troubleshooting test instructions

Differential internal earpiece outputs can be measured either with a single-ended or a differential probe.

When measuring with a single-ended probe each output is measured against the ground.

Internal handsfree output is measured using a current probe, if a special low-pass filter designed for measuring a digital amplifier is not available. Note also that when using a current probe, the input signal frequency must be set to 2kHz.

The input signal for each loop test can be single-ended.

### Required equipment

The following equipment is needed for the tests:

- Oscilloscope
- Function generator (sine waveform)
- Current probe (Internal handsfree PWM output measurement)
- Phoenix service software
- Battery voltage 3.7V

### Test procedure

Audio can be tested using the Phoenix audio routings option. Three different audio loop paths can be activated:

- External microphone to Internal earpiece
- External microphone to Internal handsfree speaker
- Internal microphone to External earpiece

Each audio loop sets routing from the specified input to the specified output enabling a quick in-out test. Loop path gains are fixed and they cannot be changed using Phoenix. Correct pins and signals for each test are presented in the following table.

### Phoenix audio loop tests and test results

The results presented in the table apply when no accessory is connected and battery voltage is set to 3.7V.

Earpiece, internal microphone and speaker are in place during measurement. Applying a headset accessory during measurement causes a significant drop in measured quantities.

The gain values presented in the table apply for a differential output vs. single-ended/differential input.

Loop test	Input terminal	Output terminal	Path gain [dB] (fixed)	Input voltage [mVp-p]	Differential output voltage [mVp-p]	Output DC level [V]	Output current [mA]
External Mic to External Earpiece	XMICP and GND	HSEAR R and GND	-2.9	1000	720	1.2	NA
		HSEAR L and GND					
External Mic to Internal Earpiece	XMICP and GND	EarP and GND	-4.0	750	490	1.2	NA
		EarN and GND					
External Mic to Internal handsfree	XMICP and GND	E2101 pad	8.5	920	2520	0	25mA (calc.)
		E2102 pad					
Internal Mic to External Earpiece	B2100 (OUT/GND)	HSEAR R and GND	22.7	100	1360	1.2	NA
		HSEAR L and GND					

## Measurement data

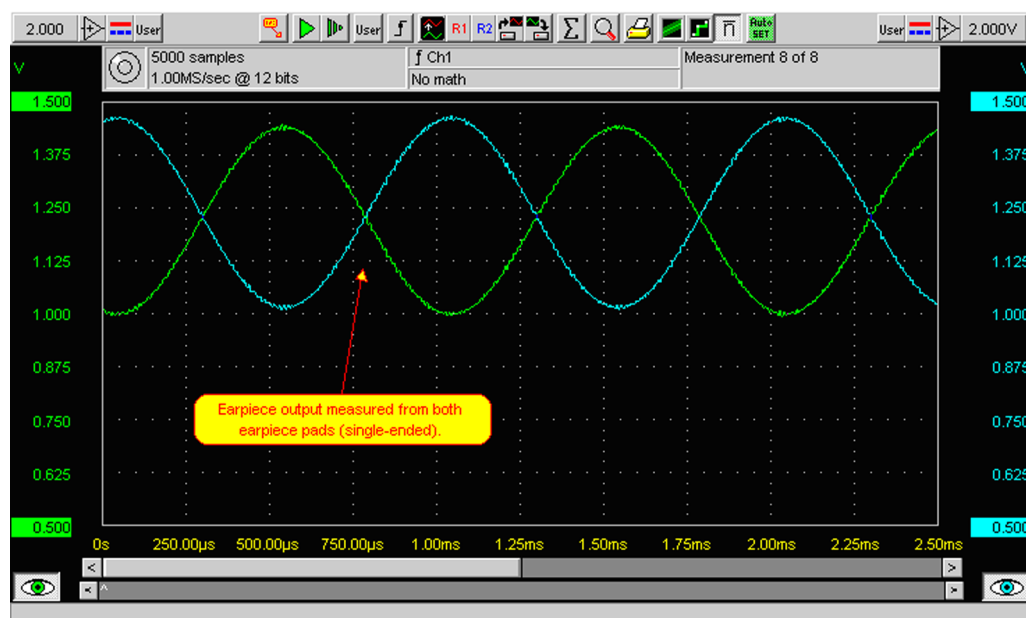


Figure 12 Single-ended output waveform of the Ext\_in\_HP\_out measurement when earpiece is connected.



Figure 13 Differential output waveform of the Ext\_in\_IHF\_out out loop measurement when speaker is connected.

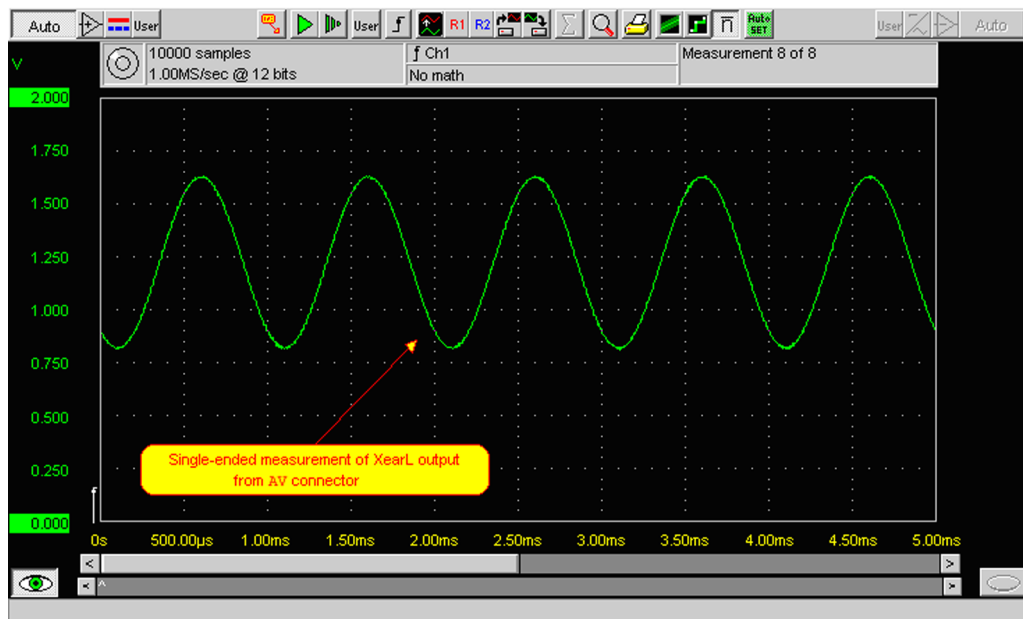
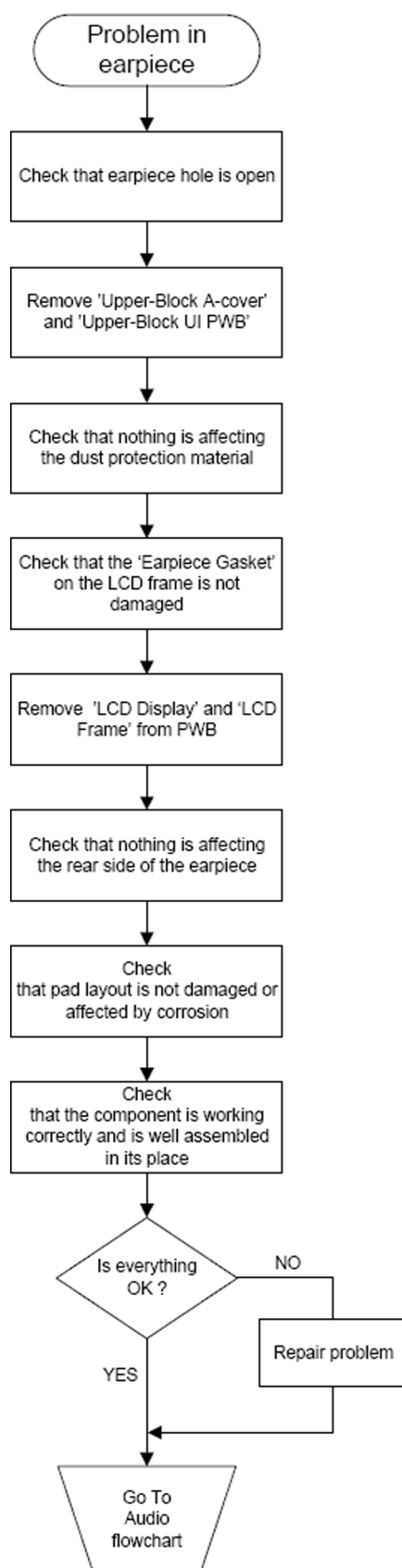


Figure 14 Single-ended output waveform of the HP\_in\_Ext\_out loop when microphone is connected.

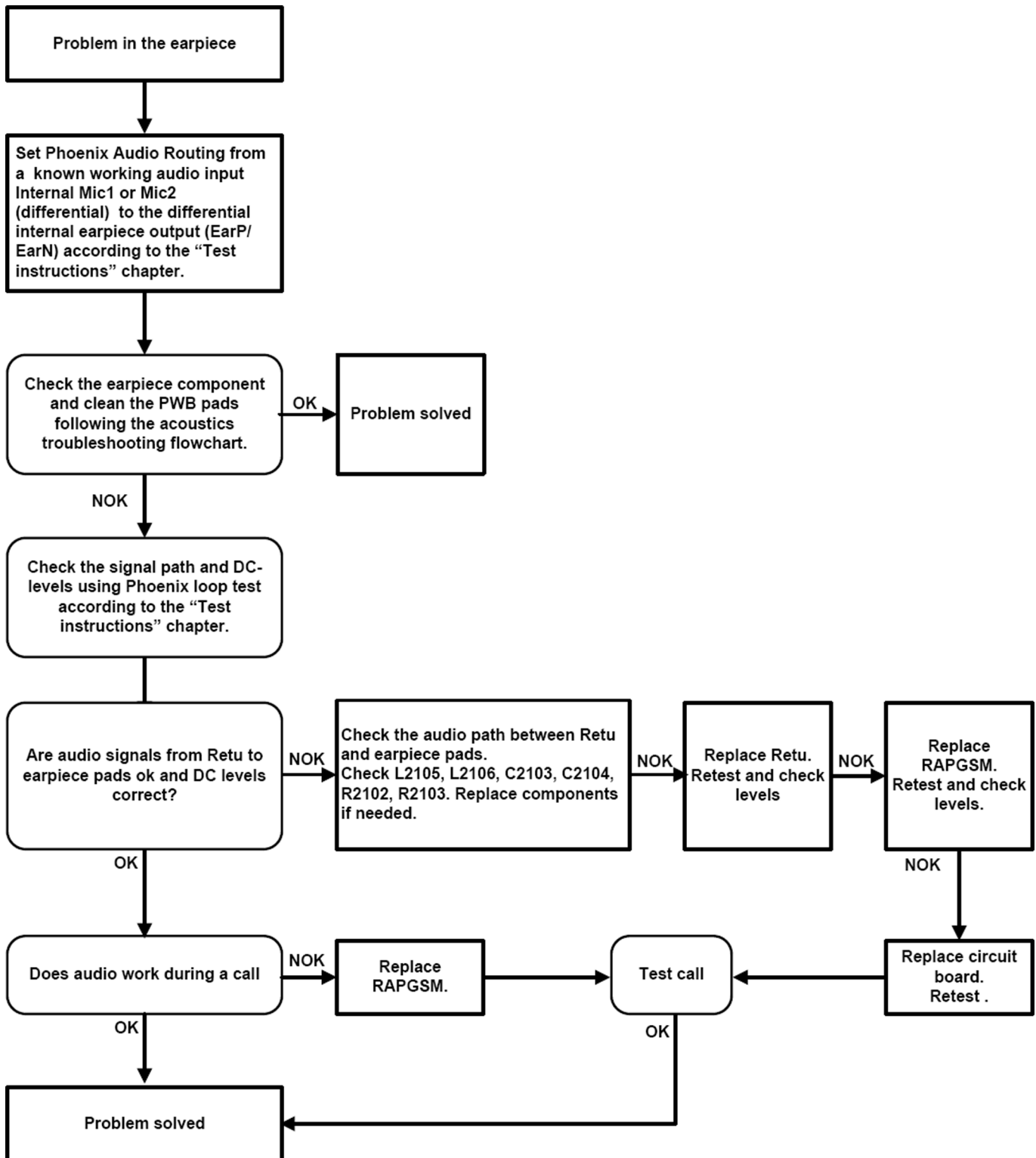
## Earpiece troubleshooting

### Troubleshooting flow



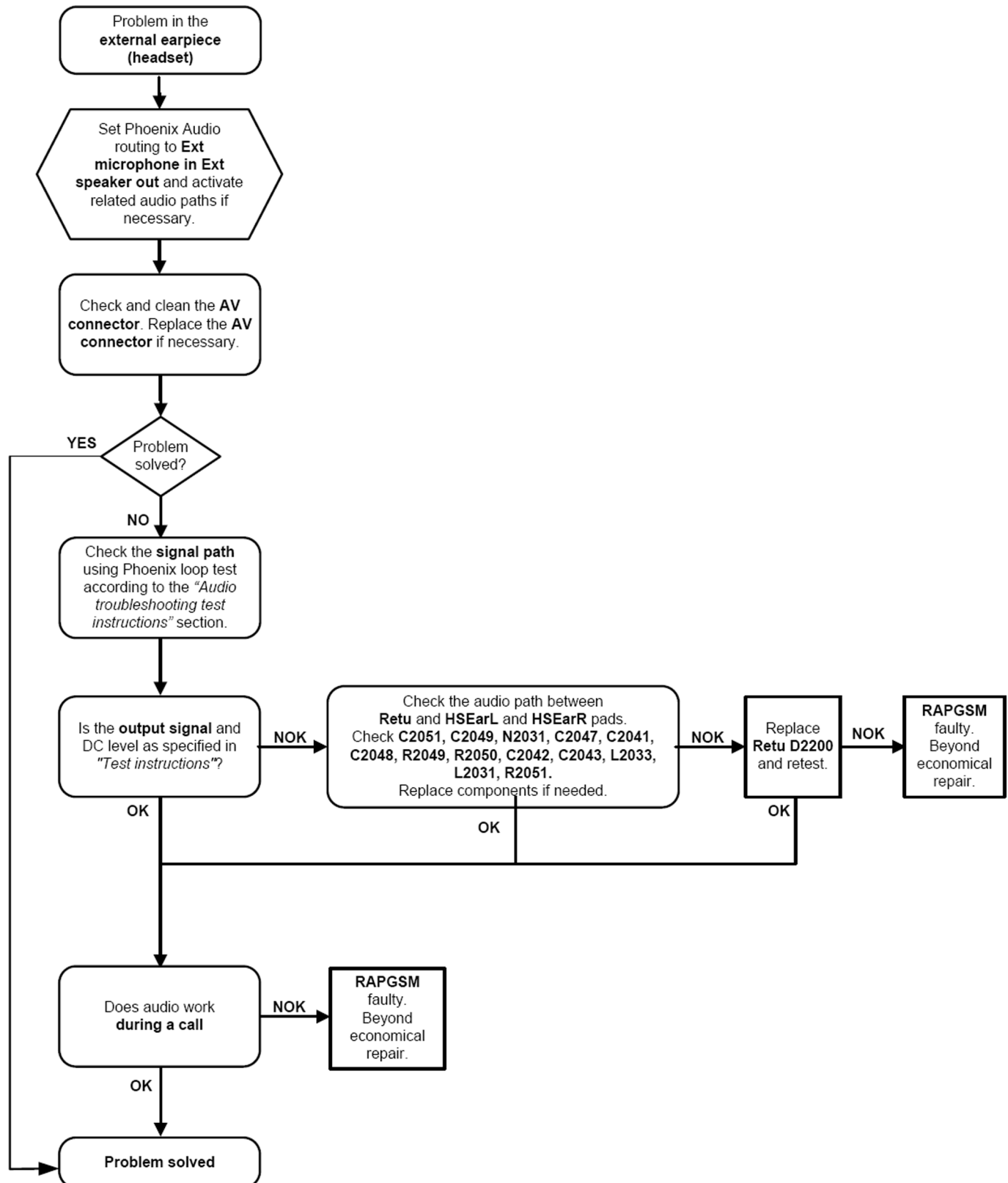
## Internal earpiece troubleshooting

### Troubleshooting flow



## External headset earpiece troubleshooting

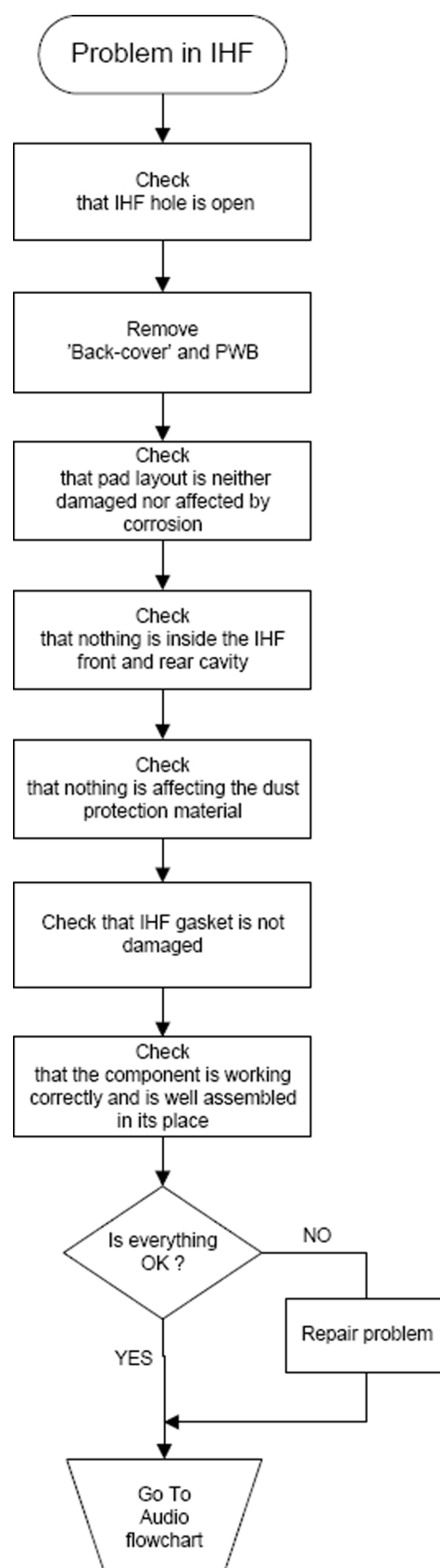
### Troubleshooting flow





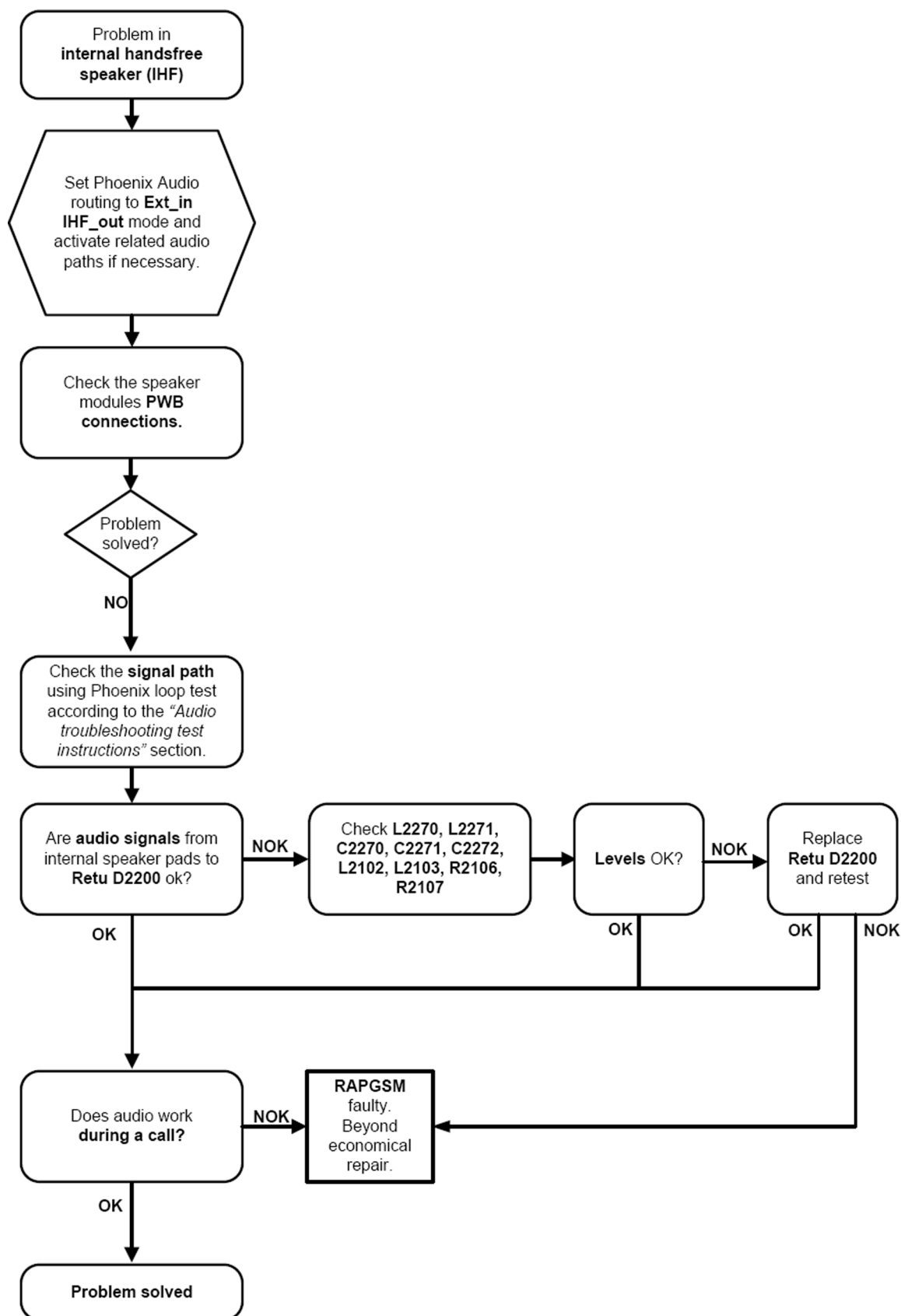
## IHF troubleshooting

### Troubleshooting flow



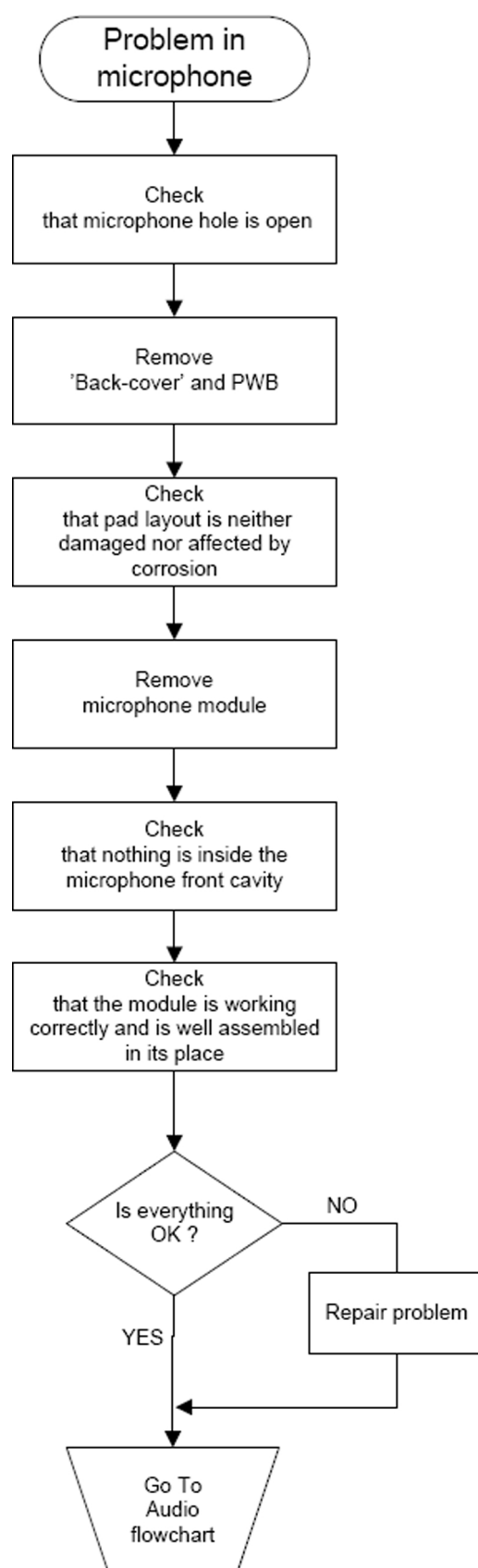
## IHF troubleshooting

### Troubleshooting flow



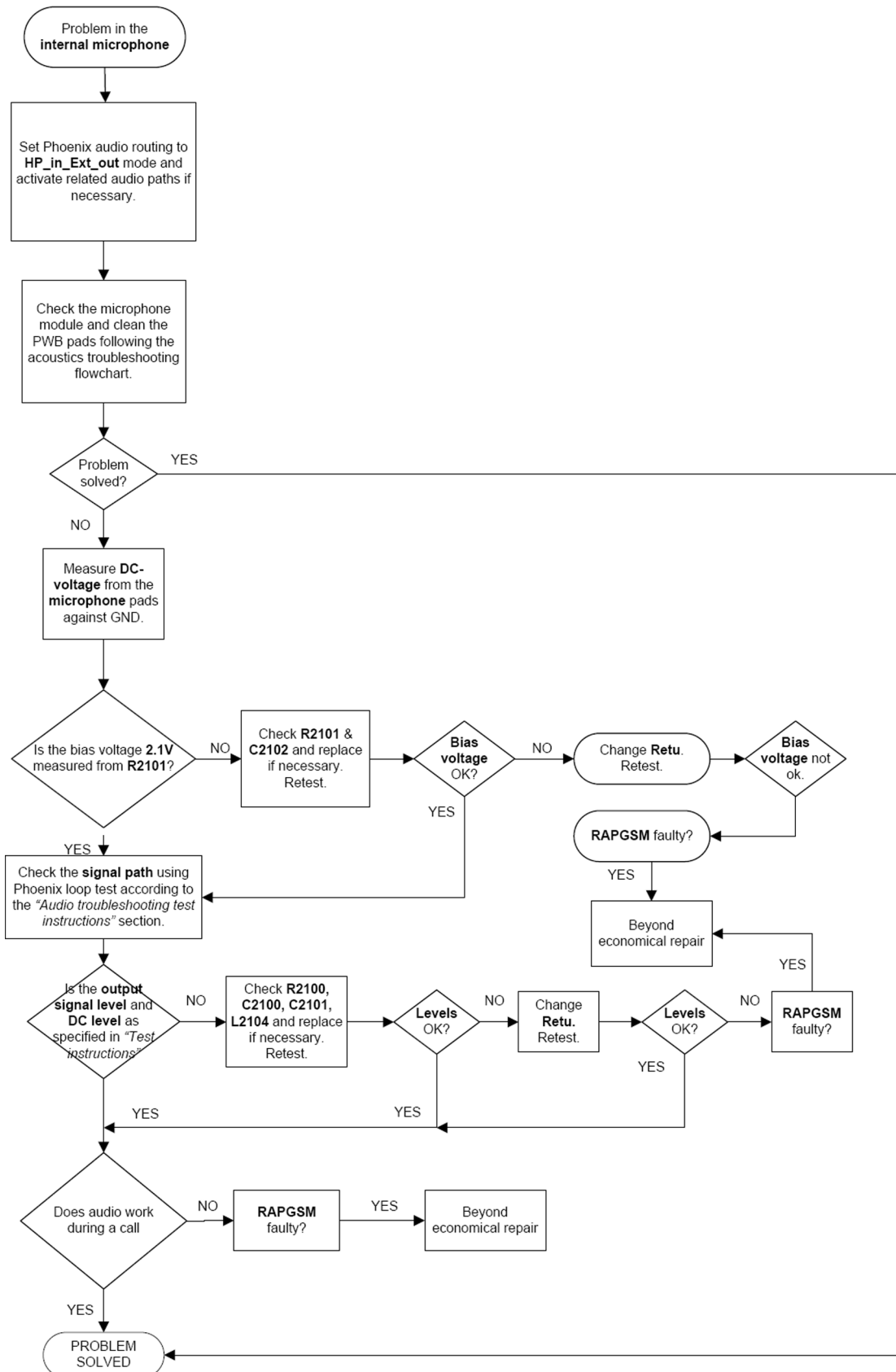
## Microphone troubleshooting

### Troubleshooting flow



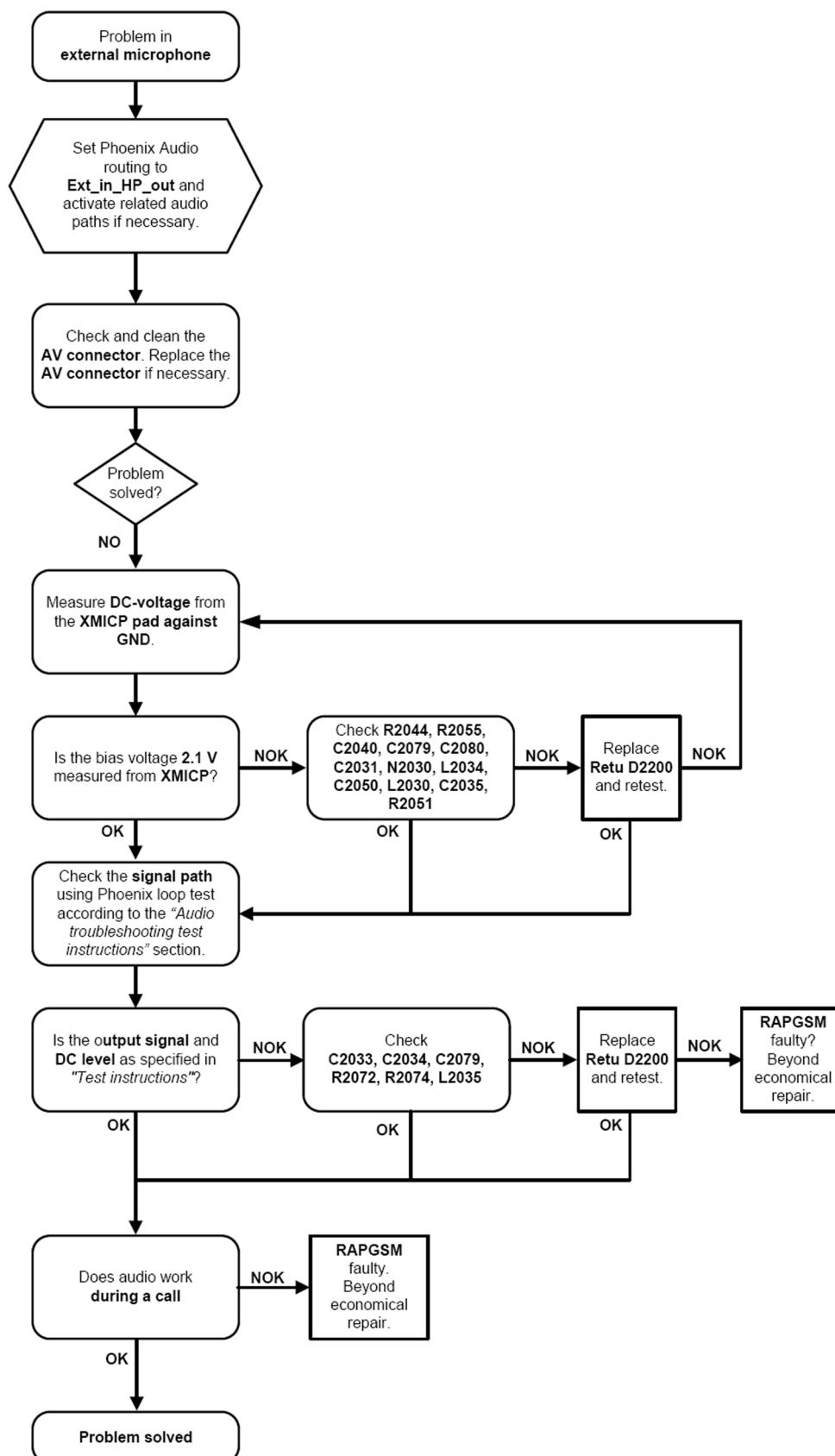
## Internal microphone troubleshooting

### Troubleshooting flow



## External headset microphone troubleshooting

### Troubleshooting flow



## ■ Connections troubleshooting

### Bluetooth troubleshooting

#### *Introduction to Bluetooth troubleshooting*

There are two main Bluetooth (BT) problems that can occur:

Problem	Description
Detachment of the BT antenna.	This would most likely happen if the device has been dropped repeatedly to the ground. It could cause the BT antenna to become loose or partially detached from the PWB.
A malfunction in the BT ASIC, BB ASICs or the phone's BT SMD components.	This is unpredictable and could have many causes i.e. SW or HW related.

The main issue is to find out if the problem is related to the BT antenna or related to the BT system or the phone's BB and then replace/fix the faulty component. For location of the antenna, please refer to the exploded view in the Parts and layouts section.

#### *Bluetooth settings for Phoenix*

### Steps

1. Start *Phoenix* service software.
2. From the **File** menu, choose **Open Product**, and then choose the correct type designator from the **Product** list.
3. Place the phone to a flash adapter in the local mode.
4. Choose **Testing**→**Bluetooth LOCALS**.
5. Locate JBT-9's serial number (12 digits) found in the type label on the back of JBT-9.  
In addition to JBT-9, also SB-6, JBT-3 and JBT-6 Bluetooth test boxes can be used.
6. In the *Bluetooth LOCALS* window, write the 12-digit serial number on the **Counterpart BT Device Address** line.  
This needs to be done only once provided that JBT-9 is not changed.
7. Place the JBT-9 box near (within 10 cm) the BT antenna and click **Run BER Test**.

### Results

Bit Error Rate test result is displayed in the *Bit Error Rate (BER) Tests* pane in the *Bluetooth LOCALS* window.

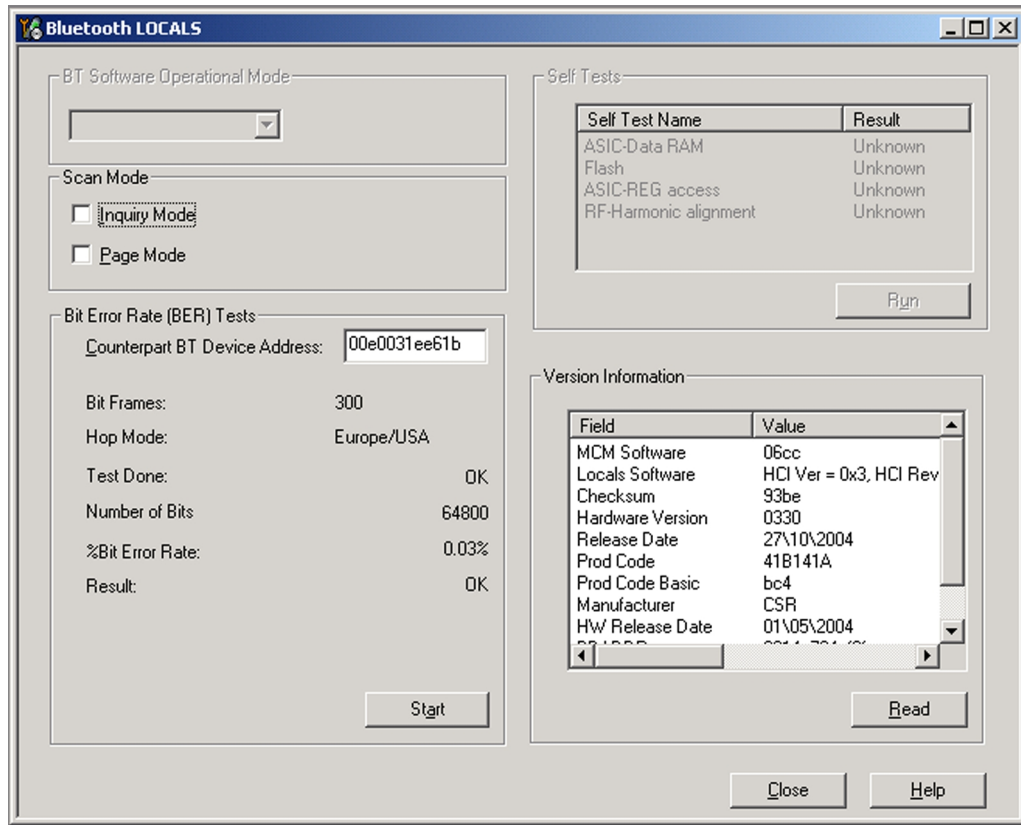


Figure 15 BER test result

### Bluetooth self tests in Phoenix

#### Steps

1. Start *Phoenix* service software.
2. Choose **File**→**Scan Product**.
3. Place the phone to a flash adapter.
4. From the **Mode** drop-down menu, set mode to **Local**.
5. Choose **Testing**→**Self Tests**.
6. In the *Self Tests* window check the following Bluetooth related tests:
  - **ST\_LPRF\_IF\_TEST**
  - **ST\_LPRF\_AUDIO\_LINES\_TEST**
  - **ST\_BT\_WAKEUP\_TEST**

7. To run the tests, click **Start**.

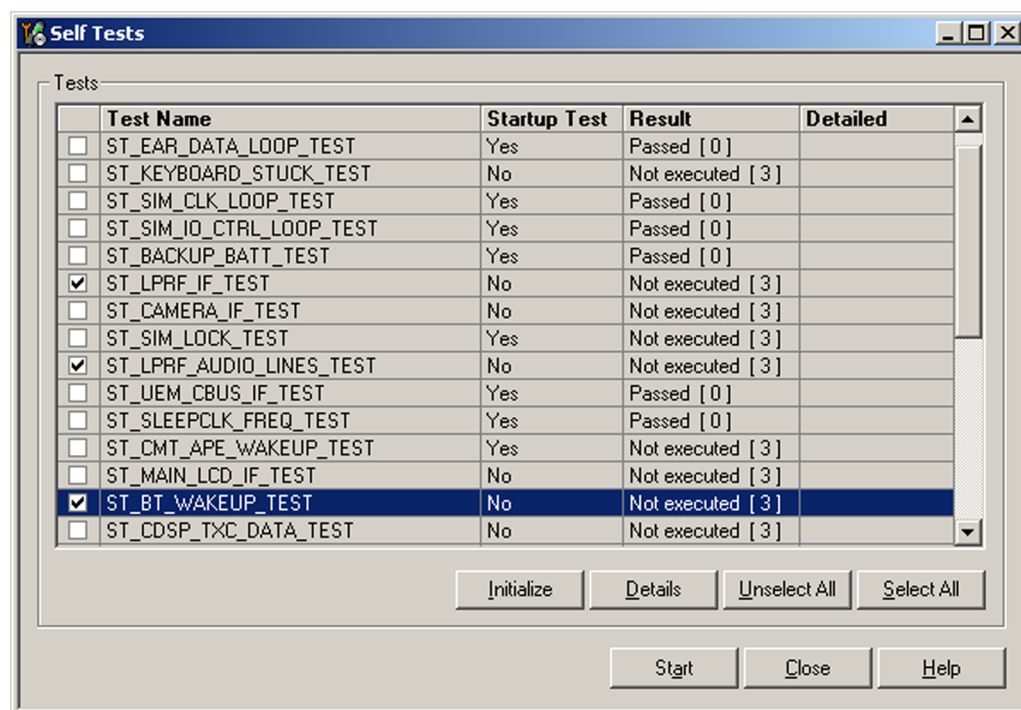


Figure 16 Bluetooth self tests in *Phoenix*

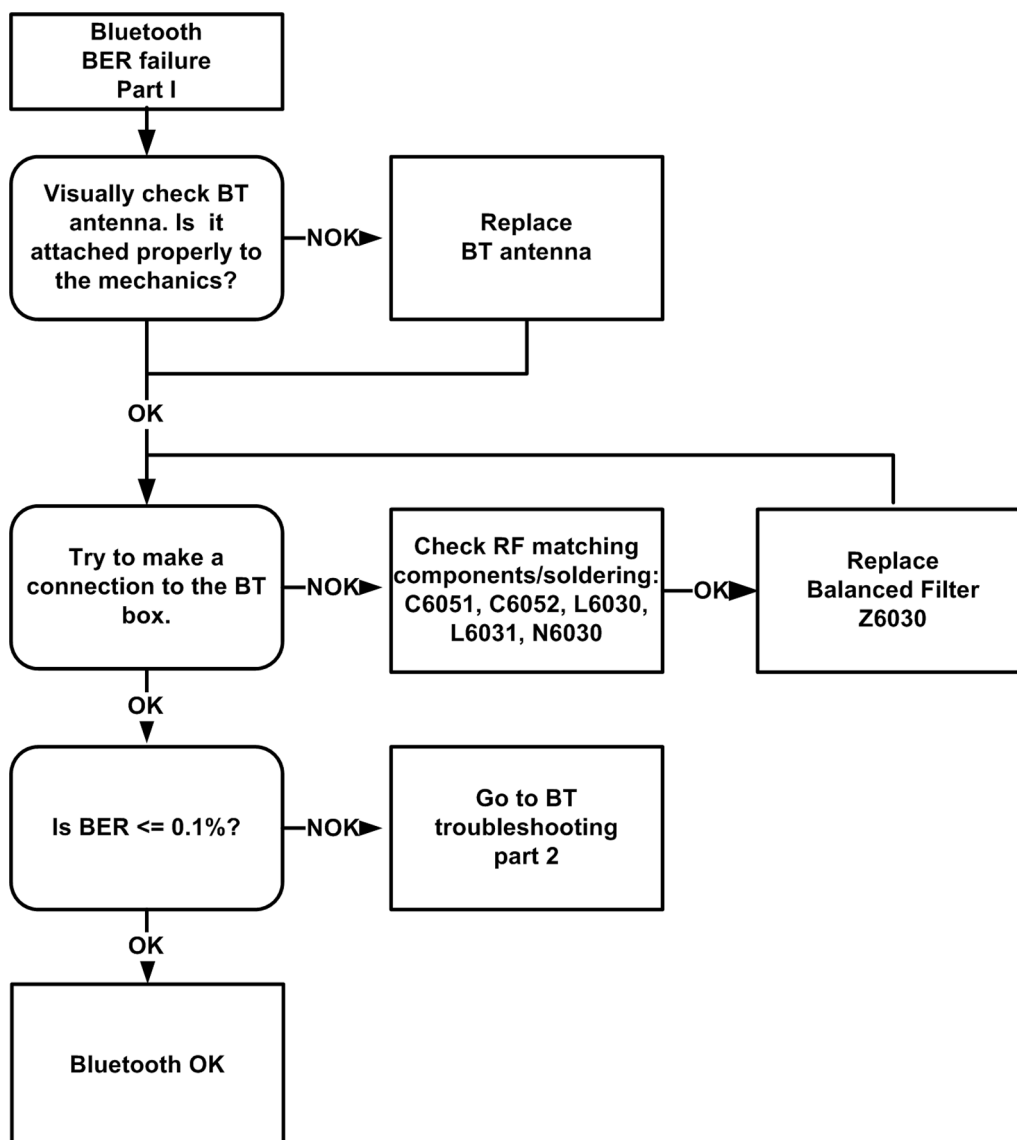
### Bluetooth BER failure troubleshooting

#### Context

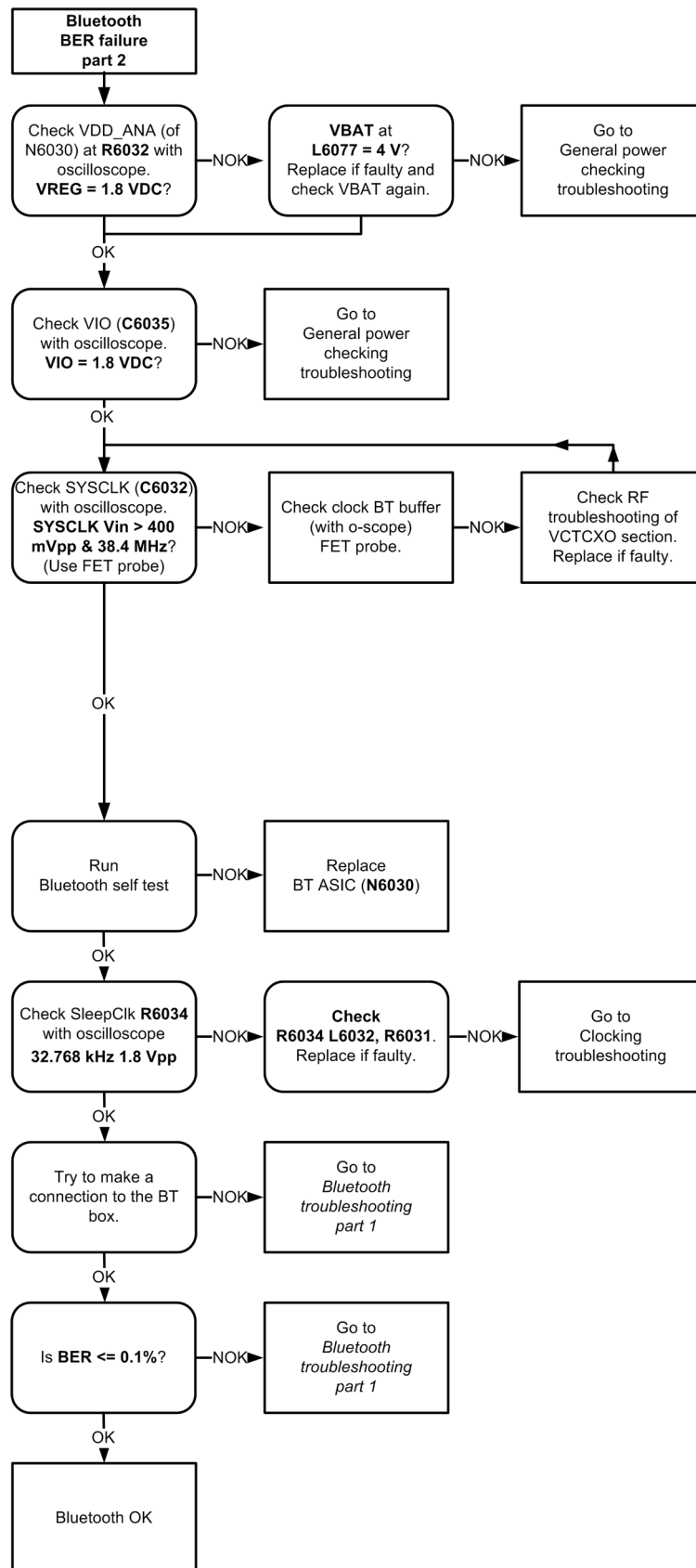
Basic encoding rules, BER, is a self-identifying and self-delimiting encoding scheme, which means that each data value can be identified, extracted and decoded individually.



## Part 1: Bluetooth self test passed but BER test failed

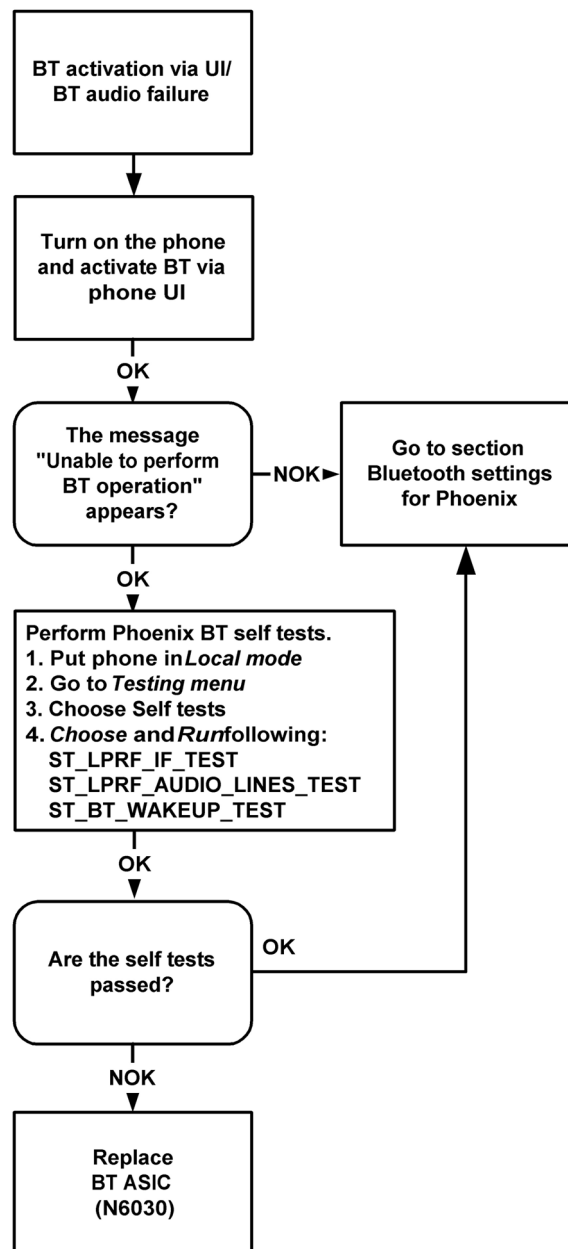


## Part 2: Bluetooth self test failed



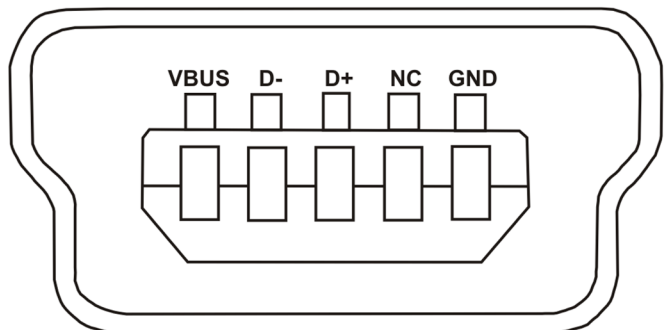
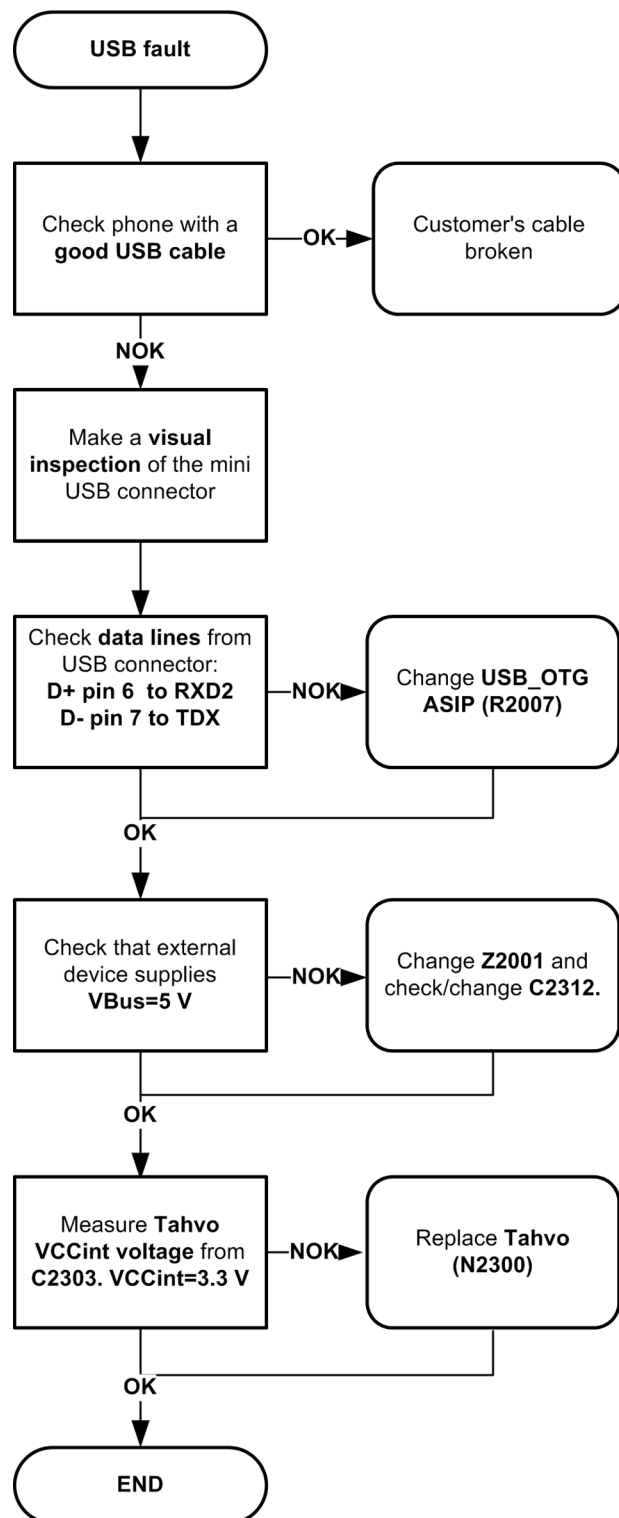
## Bluetooth audio and UI activation troubleshooting

### Troubleshooting flow



## USB interface troubleshooting

### Troubleshooting flow



## ■ Baseband manual tuning guide

### Certificate restoring for BB5 products

#### Context

This procedure is performed when the device certificate is corrupted for some reason.

All tunings (RF & Baseband, UI) must be done after performing the certificate restoring procedure.

The procedure for certificate restoring is the following:

- Flash the phone with the latest available software using FPS-8 or FPS-10.
- Create a request file.
- Send the file to Nokia by e-mail. Use the following addresses depending on your location:
  - APAC: sydney.service@nokia.com
  - CHINA: repair.ams@nokia.com
  - E&A: salo.repair@nokia.com
  - AMERICAS: fls1.usa@nokia.com
- When you receive a reply from Nokia, carry out certificate restoring.
- Tune the phone completely.

**Note:** SX-4 smart card is needed.

- If the phone resets after certificate restoring, reflash the phone again.

Required equipment and setup:

- *Phoenix* service software v 2004.39.7.70 or newer.
- The latest phone model specific *Phoenix* data package.
- PKD-1 dongle
- SX-4 smart card (Enables BB5 testing and tuning features)
- External smart card reader

**Note:** The smart card reader is only needed when FPS-8 is used. FPS-10 has an integrated smart card reader.

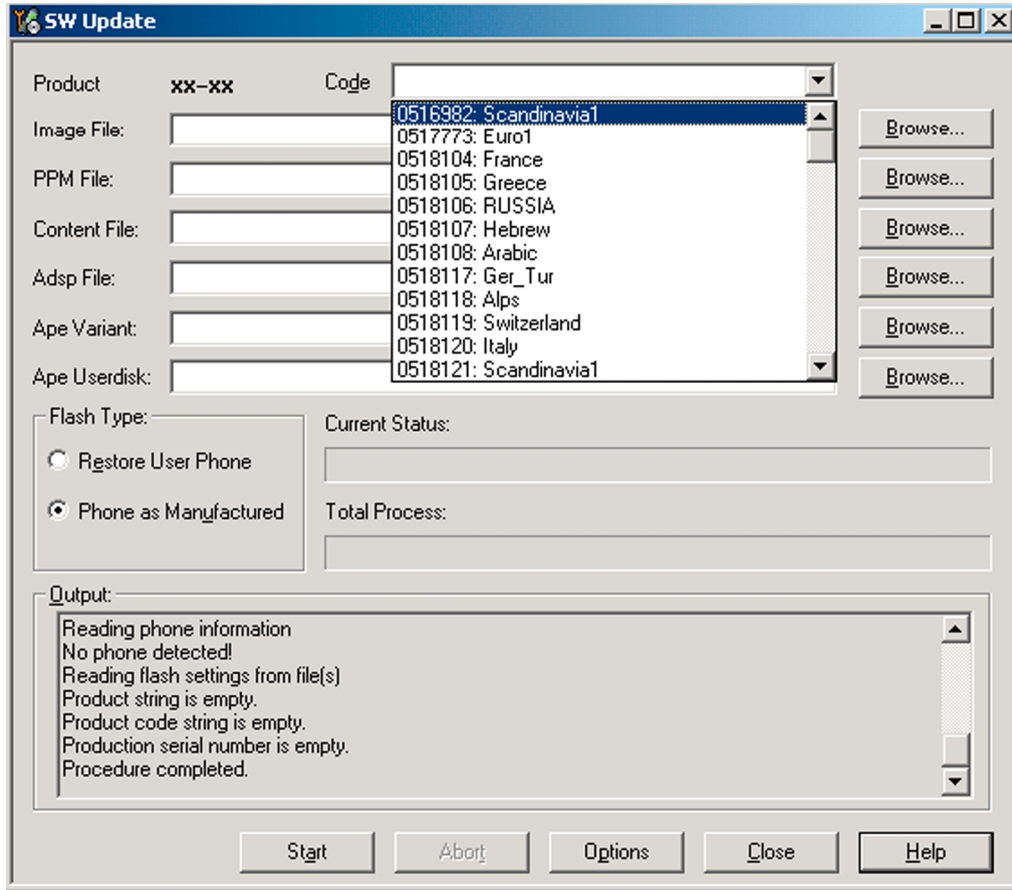
- Activated FPS-8 flash prommer **OR** FPS-10 flash prommer
- Flash update package 03.18.004 or newer for FPS-8 or FPS-10 flash prommers
- CU-4 control unit
- USB cable from PC USB Port to CU-4 control unit
- Phone model specific adapter for CU-4 control unit
- PCS-1 cable to power CU-4 from external power supply
- XCS-4 modular cable between flash prommer and CU-4

**Note:** CU-4 must be supplied with +12 V from an external power supply in all steps of certificate restoring.

#### Steps

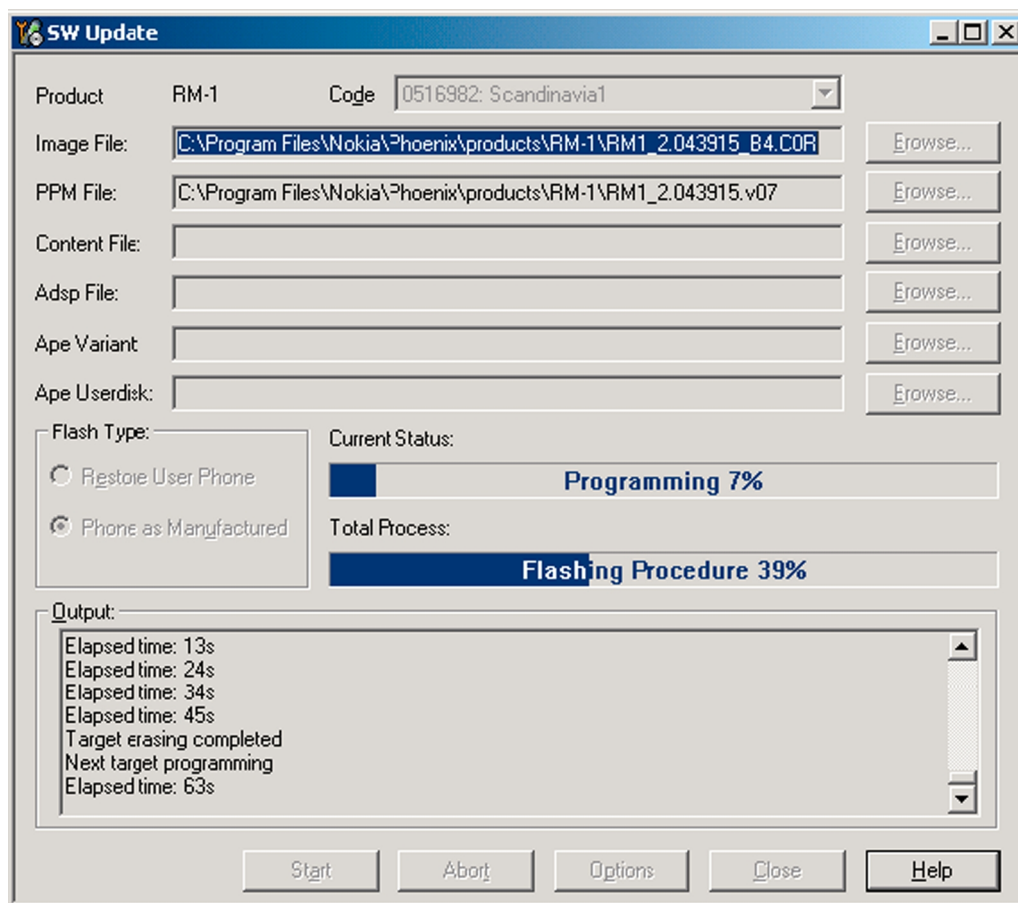
1. Program the phone software.
  - i Start *Phoenix* and login. Make sure the connection has been managed correctly for FPS-8 or FPS-10.
  - ii Update the phone MCU software to the latest available version.If the new flash is empty and the phone cannot communicate with *Phoenix*, reflash the phone.

- iii Choose the product manually from **File**→**Open Product** , and click **OK**.  
Wait for the phone type designator (e.g. "RM-1" ) to be displayed in the status bar.
- iv Go to **Flashing**→**SW Update** and wait until *Phoenix* reads the product data as shown in the following picture.



<b>Product</b>	is automatically set according to the phone support module which was opened manually, but the flash files cannot be found because the correct data cannot be read from the phone automatically.
<b>Code</b>	must be chosen manually, it determines the correct flash files to be used. Please choose the correct product code (can be seen in the phone type label) from the dropdown list.
<b>Flash Type</b>	must be set to <b>Phone as Manufactured</b> .

- v To continue, click **Start**.  
Progress bars and messages on the screen show actions during phone programming, please wait.



Programming is completed when *Flashing Completed* message is displayed.

The product type designator and MCU SW version are displayed in the status bar.

vi Close the *SW Update* window and then choose **File→Close Product**.

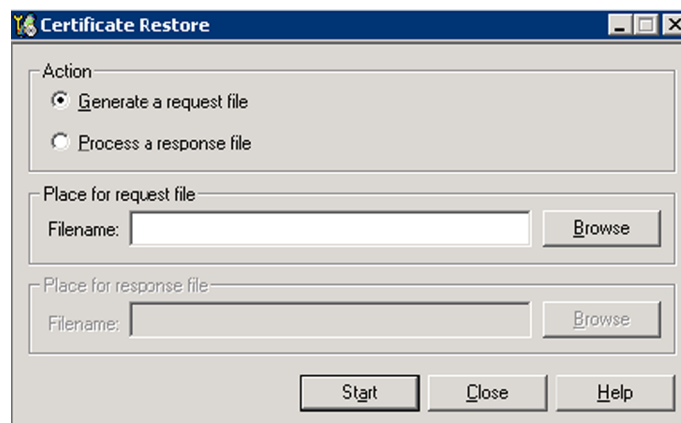
2. Create a *Request* file.

For this procedure, you must supply +12 V to CU-4 from an external power supply.

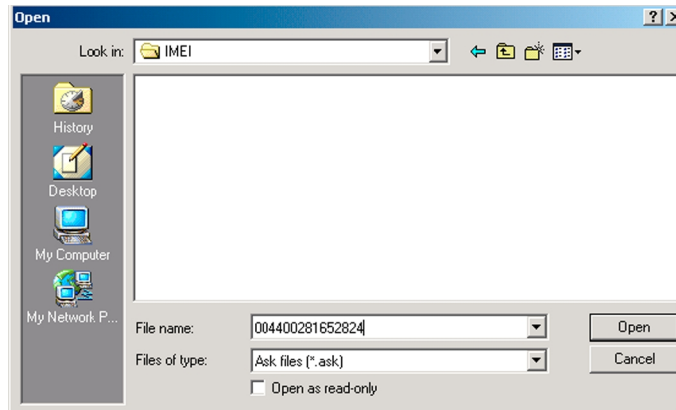
i To connect the phone with *Phoenix*, choose **File→Scan Product**.

ii Choose **Tools→Certificate Restore**.

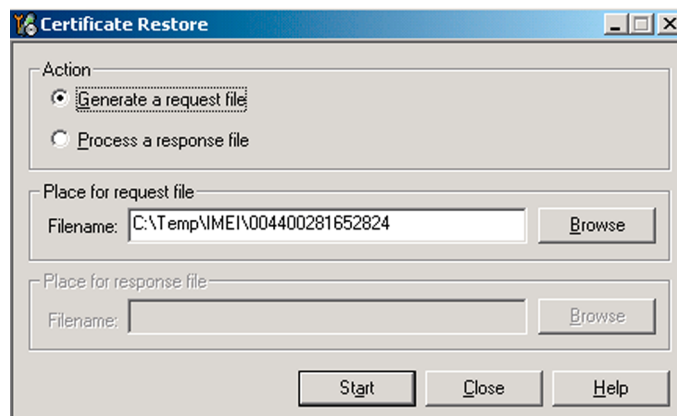
iii To choose a location for the request file, click **Browse**.



- iv Name the file so that you can easily identify it, and click **Open**.



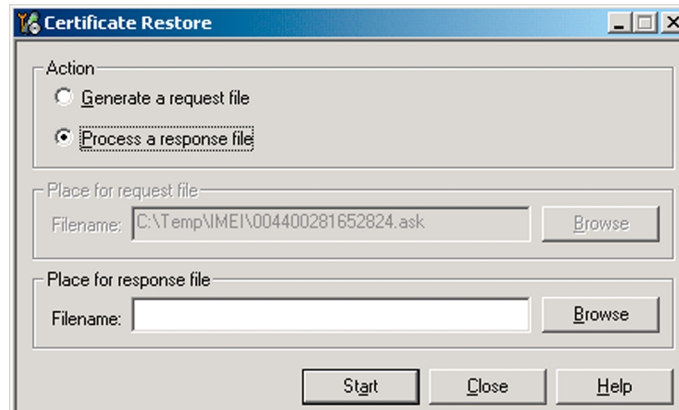
The name of the file and its location are shown.



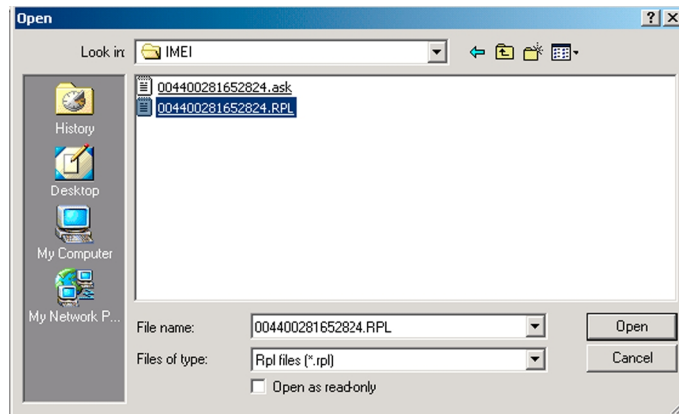
- v To create the *Request* file, click **Start**.
  - vi When the file for certificate restore has been created, send it to Nokia as an e-mail attachment.
3. Restore certificate.
- For this procedure, you must supply +12 V to CU-4 from an external power supply.
- i Save the reply file sent by Nokia to your computer.
  - ii Start *Phoenix* service software.
  - iii Choose **File**→**Scan Product**.



- iv From the **Tools** menu, choose **Certificate Restore** and select **Process a response file** in the *Action* pane.

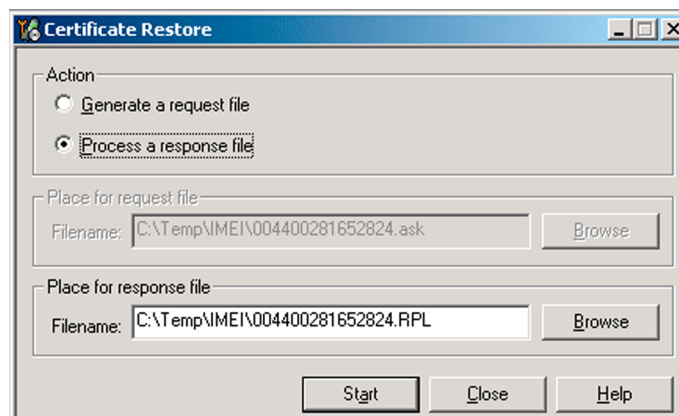


- v To choose the location where response file is saved, click **Browse**.
- vi Click **Open**.



The name of the file and the path where it is located are shown.

- vii To write the file to phone, click **Start**.



## Next actions

After a successful rewrite, you must retune the phone completely by using *Phoenix* tuning functions.

**Important:** Perform all tunings: RF, BB, and UI.

## Energy management calibration

### Prerequisites

Energy Management (EM) calibration is performed to calibrate the setting (gain and offset) of AD converters in several channels (that is, **battery voltage**, **BSI**, **battery current**) to get an accurate AD conversion result.

Hardware setup:

- An external power supply is needed.
- Supply 12V DC from an external power supply to CU-4 to power up the phone.
- The phone must be connected to a CU-4 control unit with a product-specific flash adapter.

### Steps

1. Place the phone to the docking station adapter (CU-4 is connected to the adapter).
2. Start *Phoenix* service software.
3. Choose **File**→ **Scan Product**.
4. Choose **Tuning**→**Energy Management Calibration**.
5. To show the current values in the phone memory, click **Read**, and check that communication between the phone and CU-4 works.
6. Check that the **CU-4 used** check box is checked.
7. Select the item(s) to be calibrated.

**Note:** ADC calibration has to be performed before other item(s). However, if all calibrations are selected at the same time, there is no need to perform the ADC calibration first.

8. Click **Calibrate**.

The calibration of the selected item(s) is carried out automatically.

The candidates for the new calibration values are shown in the *Calculated values* column. If the new calibration values seem to be acceptable (please refer to the following "Calibration value limits" table), click **Write** to store the new calibration values to the phone permanent memory.

Table 8 Calibration value limits

Parameter	Min.	Max.
ADC Offset	-20	20
ADC Gain	12000	14000
BSI Gain	1100	1300
VBAT Offset	2400	2650
VBAT Gain	19000	23000
VCHAR Gain	N/A	N/A
IBAT (ICal) Gain	7750	12250

9. Click **Read**, and confirm that the new calibration values are stored in the phone memory correctly. If the values are not stored to the phone memory, click **Write** and/or repeat the procedure again.
10. To end the procedure, close the *Energy Management Calibration* window.

## **4 — RF Troubleshooting and Manual Tuning Guide**

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## ■ Introduction to RF troubleshooting

On the following pages you will find a step-by-step troubleshooting procedure and reference measurements at the relevant signal points. For functional descriptions, please refer to the System module section.

### Notes on reference measurements

All measurements must be done using:

- spectrum analyser with a high-frequency high-impedance passive probe (LO-/reference frequencies and RF power levels)
- oscilloscope with a 10:1 probe (DC-voltages and low frequency signals)

**Important:** All measurements with an RF coupler must be performed in an RF shielded environment, or where there are no transmissions on the same frequencies. This may disturb sensitive receiver measurements.

### Repairing this phone - important

The RF section of the phone is built around one RF ASIC. Before changing the RF ASIC, please make sure that supply voltages and serial communication coming from baseband to RF are OK.

Please note that the grounding of the FEM module is directly below the FEM module. Therefore, it is difficult to check or change the module.

Most RF semiconductors are static discharge sensitive! ESD protection must be taken care of during repair (ground straps and ESD soldering irons). The RF ASIC and FEM are moisture sensitive, so parts must be pre-baked prior to soldering.

In addition to key components, there are lot of discrete components (resistors, inductors and capacitors) which troubleshooting is done mainly by checking if the soldering of the component is done properly.

Capacitor can be checked for shorts and resistors for value by means of an ohmmeter, but be aware in-circuit measurements should be evaluated carefully.

Keep in mind that all measured voltages or RF levels depicted in the service manual are rough figures. Especially RF levels vary because of different measuring equipment or different grounding of the probe used.

When using an RF probe, use a pair of metallic tweezers to connect the probe ground to the PWB ground as close to the measurement point as possible. If measurements are performed in a product specific module jig, then "GND" pads should be used for the probe ground.

### Supported bands

RM-274 supports GSM900, GSM1800 and GSM1900.

Make sure to investigate only the bands, which the phone is made for.

## ■ Receiver troubleshooting

Rx can be tested by making a phone call or in the local mode. For the local mode testing, use Phoenix service software.

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In GSM, the input signal can be either a real GSM signal or a CW signal that is 67.771kHz up from the carrier frequency.

For service tool usage instructions, refer to section Service Tools and Service Concepts.

## General instructions for RX troubleshooting

### Steps

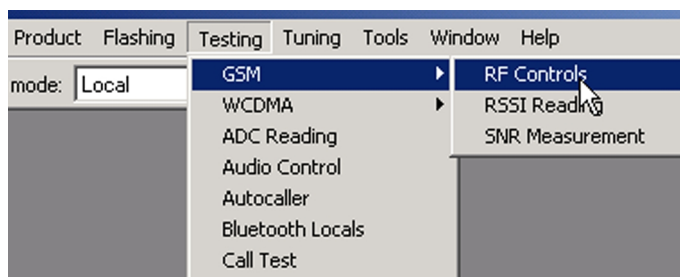
1. Connect a test jig to a computer with a DAU-9S cable or to a FPS-10 flash prommer with a modular cable (XCS-4).

Make sure that you have a PKD-1 dongle connected to the computer's parallel port.

2. Connect CU-4 with 12 V supply. The DC supply voltage is set to 3.7 V by default (in Phoenix).
3. Connect an RF cable between the RF connector of the module test jig (MJ-122) and measurement equipment or alternatively use a 50  $\Omega$  (at least 2 W) dummy load in the module test jig RF connector, otherwise the RF part may be damaged.

**Note:** Make sure that all connections are made to the correct RF connector.

4. Set Rx on.
  - i Set the phone module to the test jig and start *Phoenix service software*.
  - ii Initialize connection to the phone. (With the FPS-10 prommer use FPS10\_USB or FPS10\_TCP drivers, depending on connection type. When using DAU-9S select FBUS).
  - iii From the File menu, choose product: **File -> Choose Product -> xx-x\*** (\* = type designator of the phone, eg. RM-274), or press **Ctrl + R** to scan product.
  - iv From the toolbar, set operating mode to "Local".
5. EGSM900/1800/1900 troubleshooting
  - i From the Testing menu, activate the *RF Controls* window: **Testing -> GSM -> RF Controls**.



- ii In the *RF Controls* window:
  - Select band.
  - Set Active unit to "Rx" (Default).
  - Set Operation mode to "Burst" (Default).
  - Set Rx/Tx channel (see table below).
  - Apply a frequency (see table below) to the RF-connector.

**Note:** Remember to compensate for cable attenuation, specific for MJ-122. You will find the values in the Service tools section.

Apply a signal to the RF-connector (remember to compensate for cable attenuation). See values in the table below.

Band	Channel (RX and TX)	Input frequency (MHz)	Offset (kHz)	Power level (dBm)
GSM900	37	942.46771	67.710	-90
GSM1800	700	1842.86771	67.710	-90
GSM1900	661	1960.06771	67.710	-90

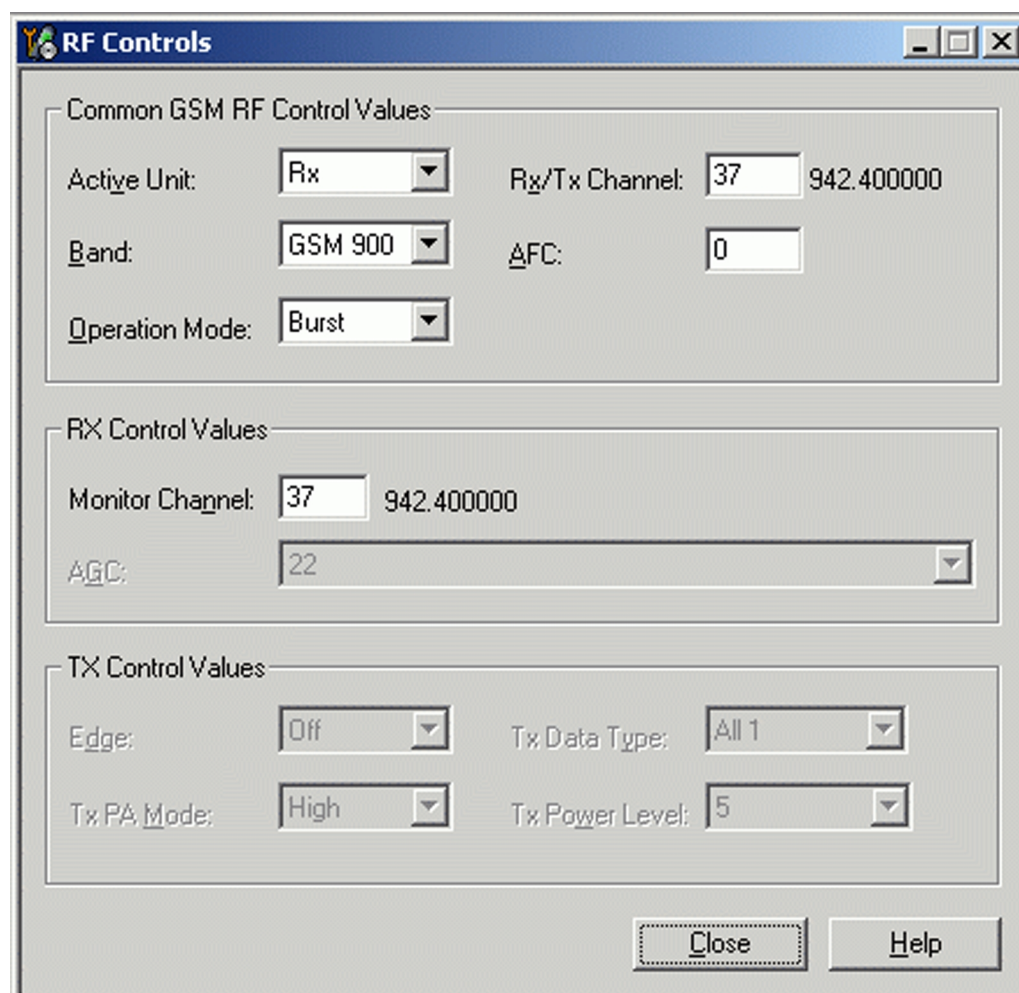


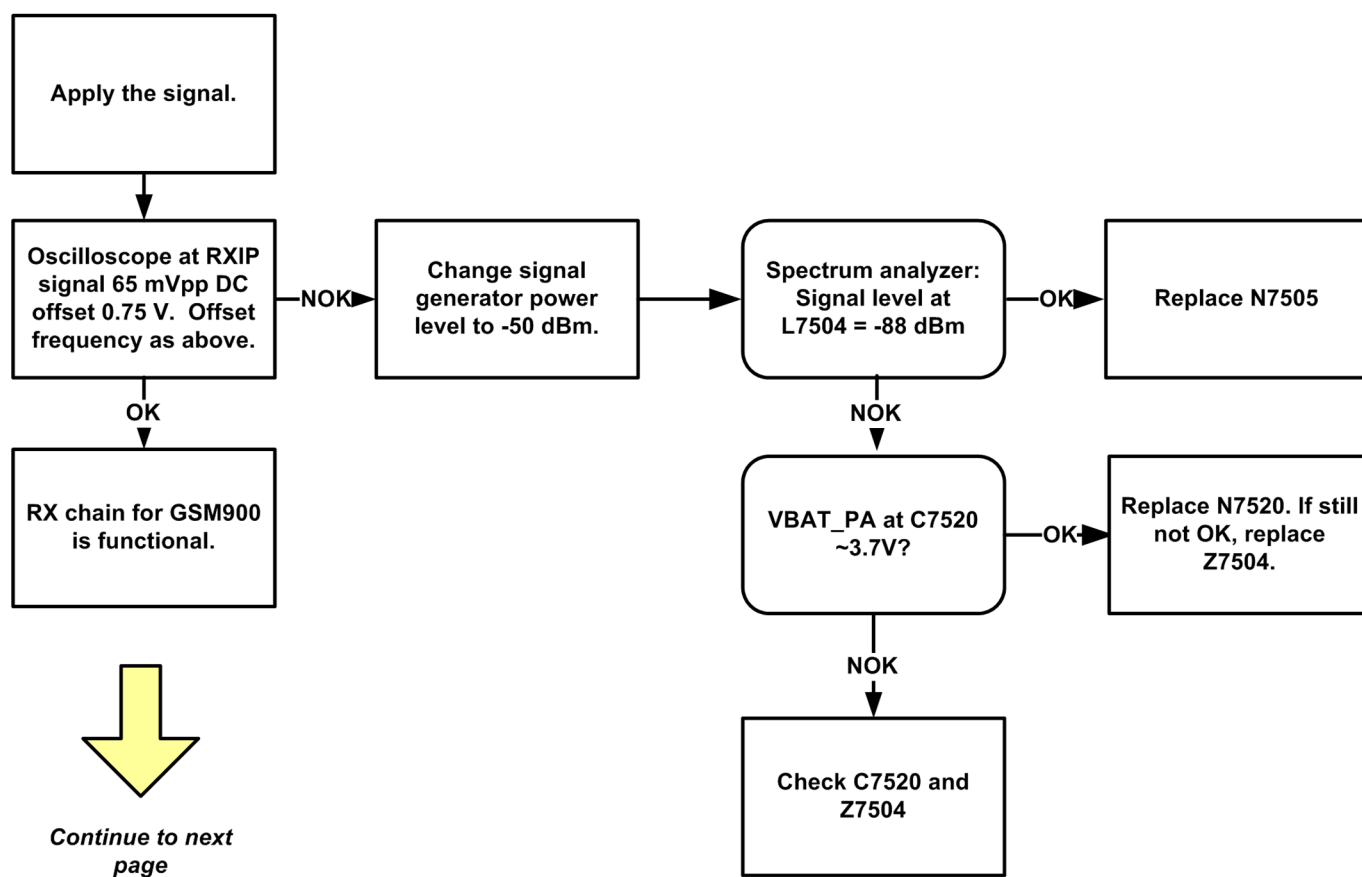
Figure 18 RF Controls window

## Receiver (RX) troubleshooting

### Receiver troubleshooting

Apply a signal according to the table in [General instructions for RX troubleshooting \(page \)](#)

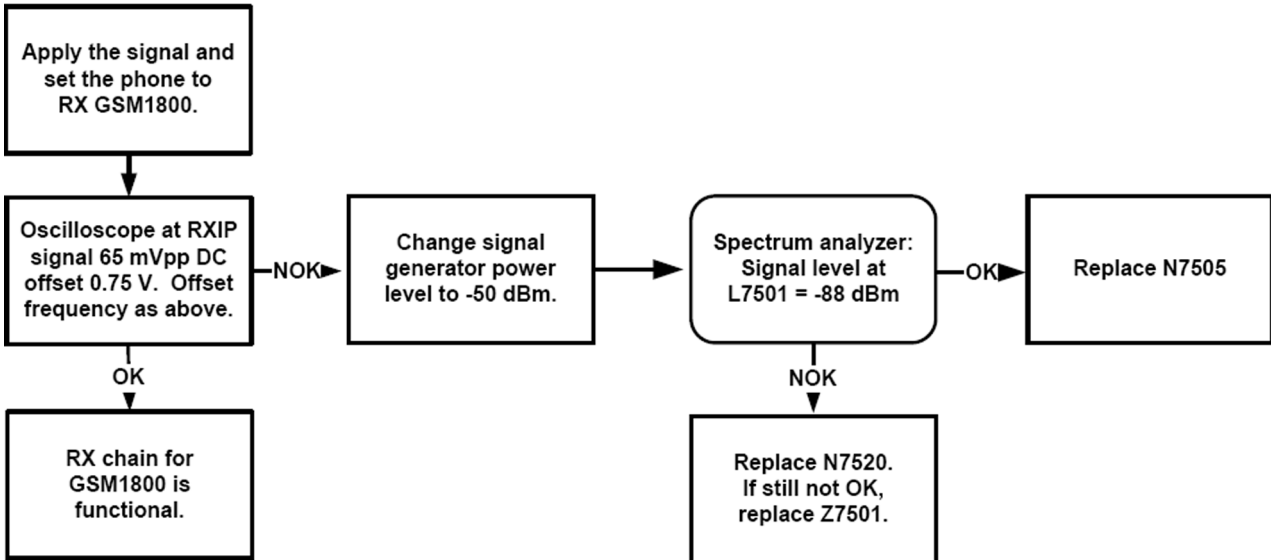
## GSM900



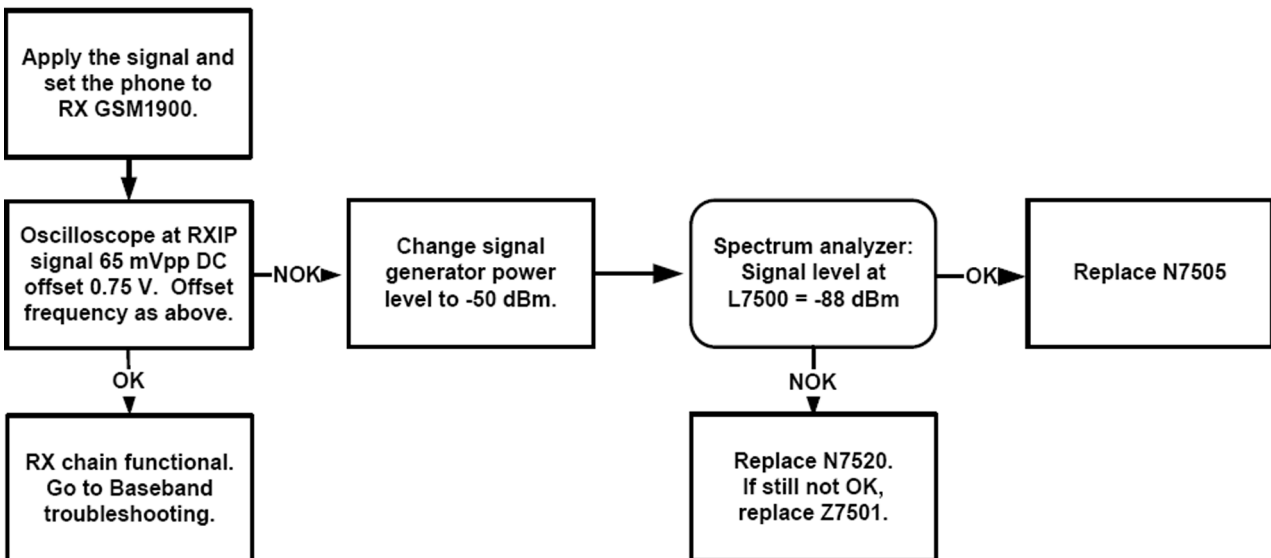
Continued from  
previous page



### GSM1800



### GSM1900



## GSM Rx chain activation for manual measurements / GSM RSSI measurement

### Context

RSSI signal measurement is the main Rx troubleshooting measurement. The test measures the strength of the received signal.

I and Q branches can be measured separately. In GSM, the input signal can be either a real GSM signal or a CW (Continuous Wave) signal that is 67.771 kHz above the carrier frequency.

### Steps

1. Start *Phoenix* service software.
2. Choose **Testing**→**GSM**→**RSSI Reading**.
3. Set the RF signal generator for a channel frequency +67.771 kHz in CW mode with a -80 dBm signal level. Alternatively set the cellular tester downlink channel to the appropriate channel. Make sure that the tester is set to continuous mode, not to burst mode.
4. In the *RSSI Reading* window, select the appropriate band and channel.

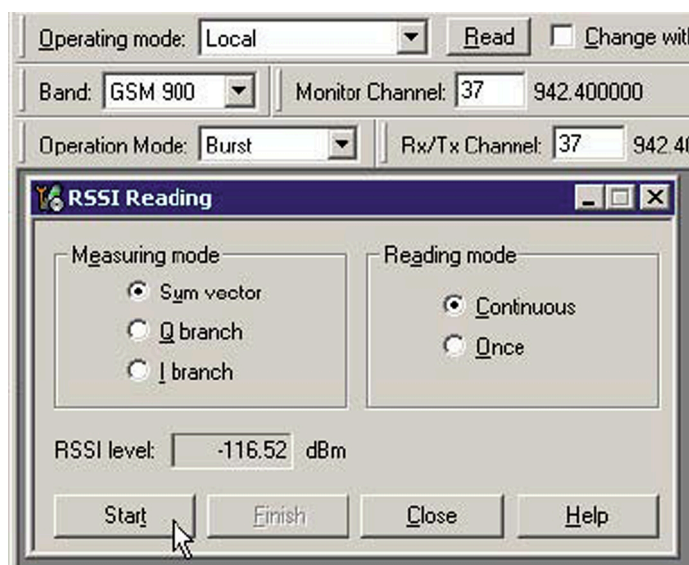


Figure 19 *RSSI Reading* window

5. To start the measurement, activate GSM Rx chain, click **Start**.

### Results

RSSI reading values of the selected band and channel are displayed. The RSSI level must be the same value as that which is set at the signal generator (-80 dBm).

## ■ Transmitter troubleshooting

### General instructions for TX troubleshooting

#### Context

- Tx troubleshooting requires Tx operation.
- Do not transmit on frequencies that are in use!
- Transmitter can be controlled in the local mode for diagnostic purposes.
- The most useful Phoenix tool for GSM transmitter testing is "RF Controls".

- Tx IQ tuning and Tx power tuning can be also used in some cases.
- Remember that retuning is not a fix! Phones are tuned correctly in production.

The first set of steps instructs how to assemble the test setup. This setup is general for all Tx troubleshooting tasks.

Alternative steps provide specific troubleshooting instructions for *Phoenix* service software.

**Caution:** Never activate the GSM transmitter without a proper antenna load. There should be always 50  $\Omega$  load connected to the RF connector (antenna, RF-measurement equipment or at least 2 W dummy load), otherwise the GSM Power amplifier may be damaged.

## Steps

1. Connect a test jig to a computer with a DAU-9S cable or to a FPS-10 flash prommer with a modular cable (XCS-4).

Make sure that you have a PKD-1 dongle connected to the computer's parallel port.

2. Connect CU-4 with 12 V supply. The DC supply voltage is set to 3.7 V by default (in Phoenix).
3. Connect an RF cable between the RF connector of the module test jig (MJ-122) and measurement equipment or alternatively use a 50  $\Omega$  (at least 2 W) dummy load in the module test jig RF connector, otherwise GSM may be damaged.

**Note:** There are two antenna connectors in the module jig:

- one for GSM
- one for Bluetooth

Make sure that all connections are made to the correct RF connector.

Normally a spectrum analyser is used as measurement equipment.

**Note:** The maximum input power of a spectrum analyser is +30 dBm.

To prevent any damage, it is recommended to use 10 dB attenuator on the spectrum analyzer input.

4. Set Tx on.
  - i Set the phone module to the test jig and start *Phoenix service software*.
  - ii Initialize connection to the phone. (With the FPS-10 prommer use FPS10\_USB or FPS10\_TCP drivers, depending on connection type. When using DAU-9S select FBUS driver).
  - iii From the File menu, choose product: **File -> Choose Product -> xx-x\*** (\* = type designator of the phone, e.g. RM-274), or press **Ctrl + R** to scan product.
  - iv From the toolbar, set operating mode to "Local".
5. GSM900/1800/1900 troubleshooting
  - i From the Testing menu, activate the *RF Controls* window: **Testing -> GSM -> RF Controls**.



- ii In the *RF Controls* window:
  - Select band "GSM900" or "GSM1800" or "GSM1900".
  - Set Active unit to "Tx" (Default = "Rx").



- Set Operation mode to "Burst" (Default).
- Set Tx data type to "All1" (Default).
- Set Rx/Tx channel (see table below)
- Set Edge to "Off" (Default).
- Set Tx PA mode to "High" (Default).
- Set power level (see table below)

Band	Channel (RX and TX)	TX power level
GSM900	37	5
GSM1800	700	0
GSM1900	661	0

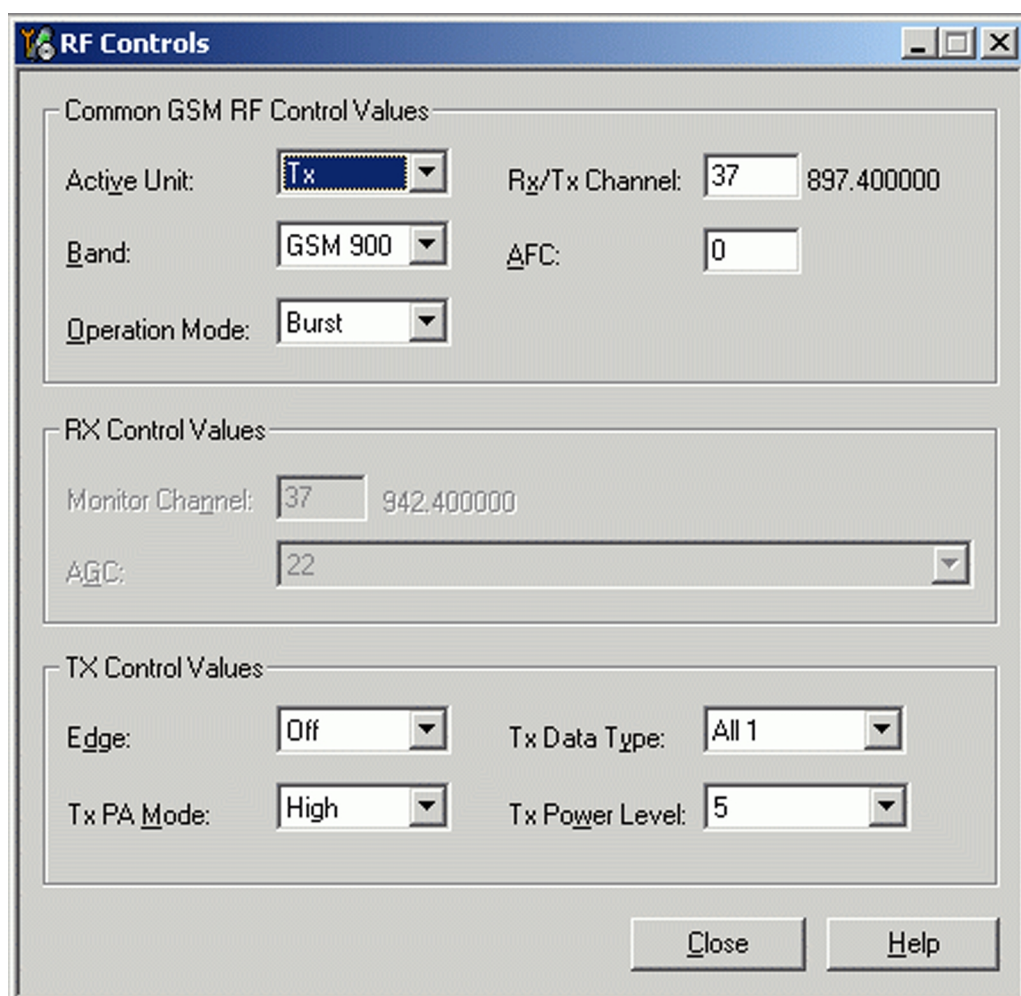
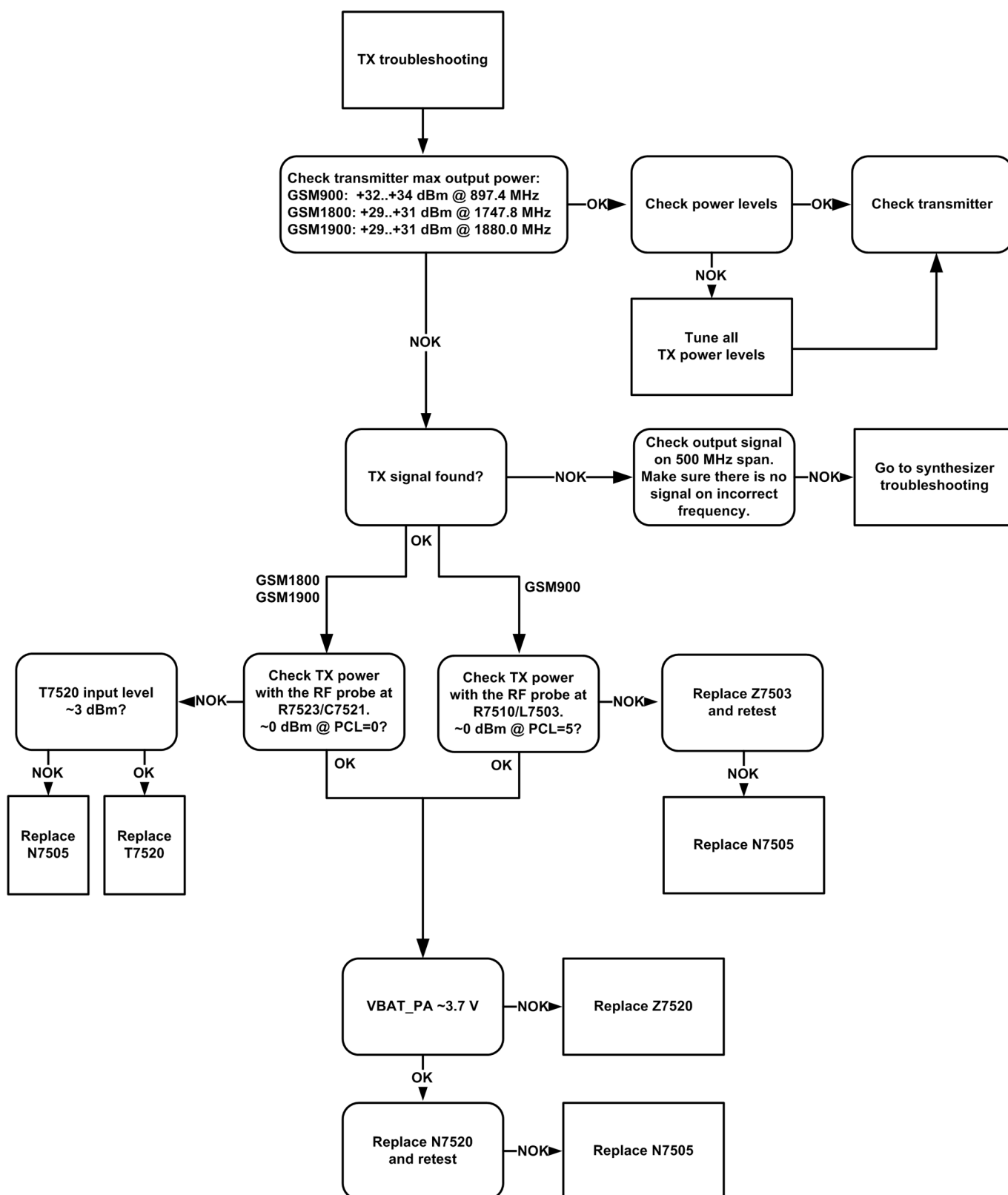


Figure 20 RF Controls window

## Transceiver (TX) troubleshooting

### Troubleshooting flow





## Checking antenna functionality

### GSM antenna

In the GSM antenna, there is one feed and two GND contacts.

Between GND1 and Feed, a DC short-circuit can be measured.

GND2 has no DC connection to the other contacts.

The antenna is functioning normally, if the contact pads hit the antenna C-clips on the PWB and the antenna is visually intact.

### BT antenna

The BT antenna is (as the GSM antenna) placed on the flex foil on the antenna module. It has one feed and one short contact. The antenna is functioning normally, if the contact pads hit the antenna C-clips on the PWB and the antenna is visually intact.

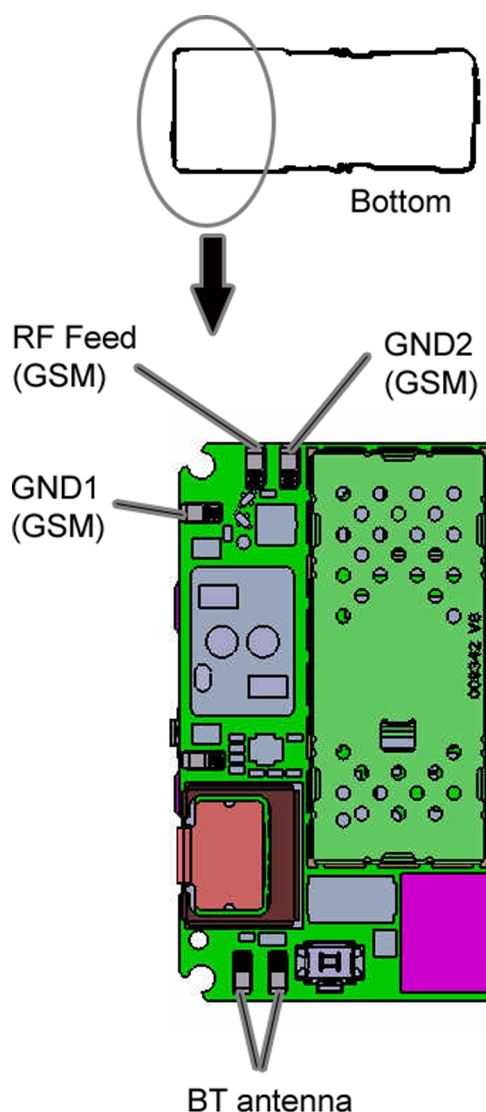


Figure 21 Location of the GSM and BT antenna C-clips on the PWB

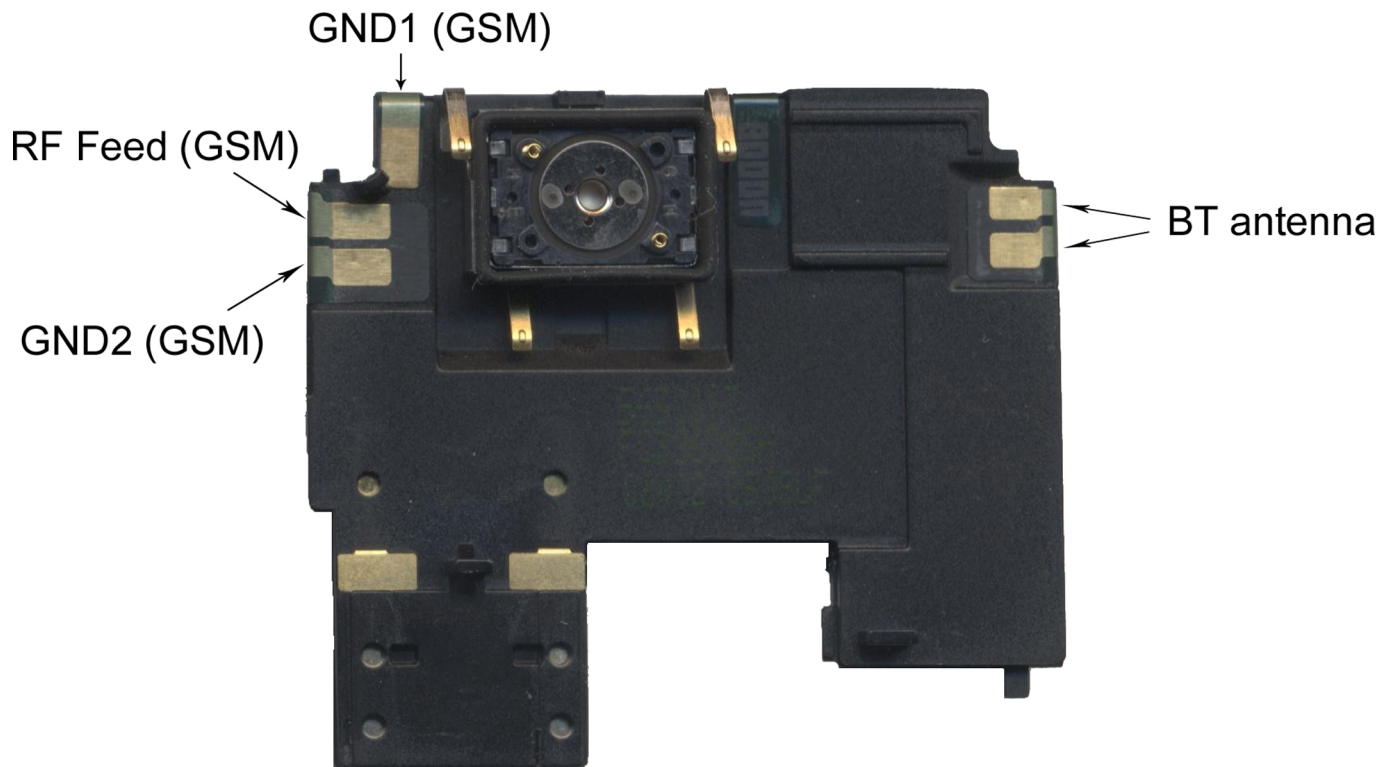


Figure 22 GSM and BT antenna contact pads on the antenna module

### Antenna C-clips

When checking the antenna functionality, you can also check that the antenna C-clips are intact (that is, there are no cracks/bends in them).

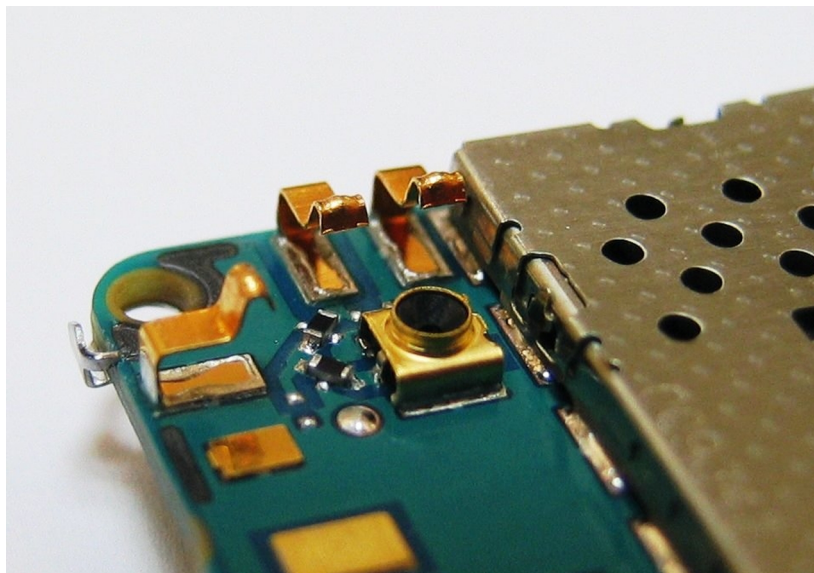
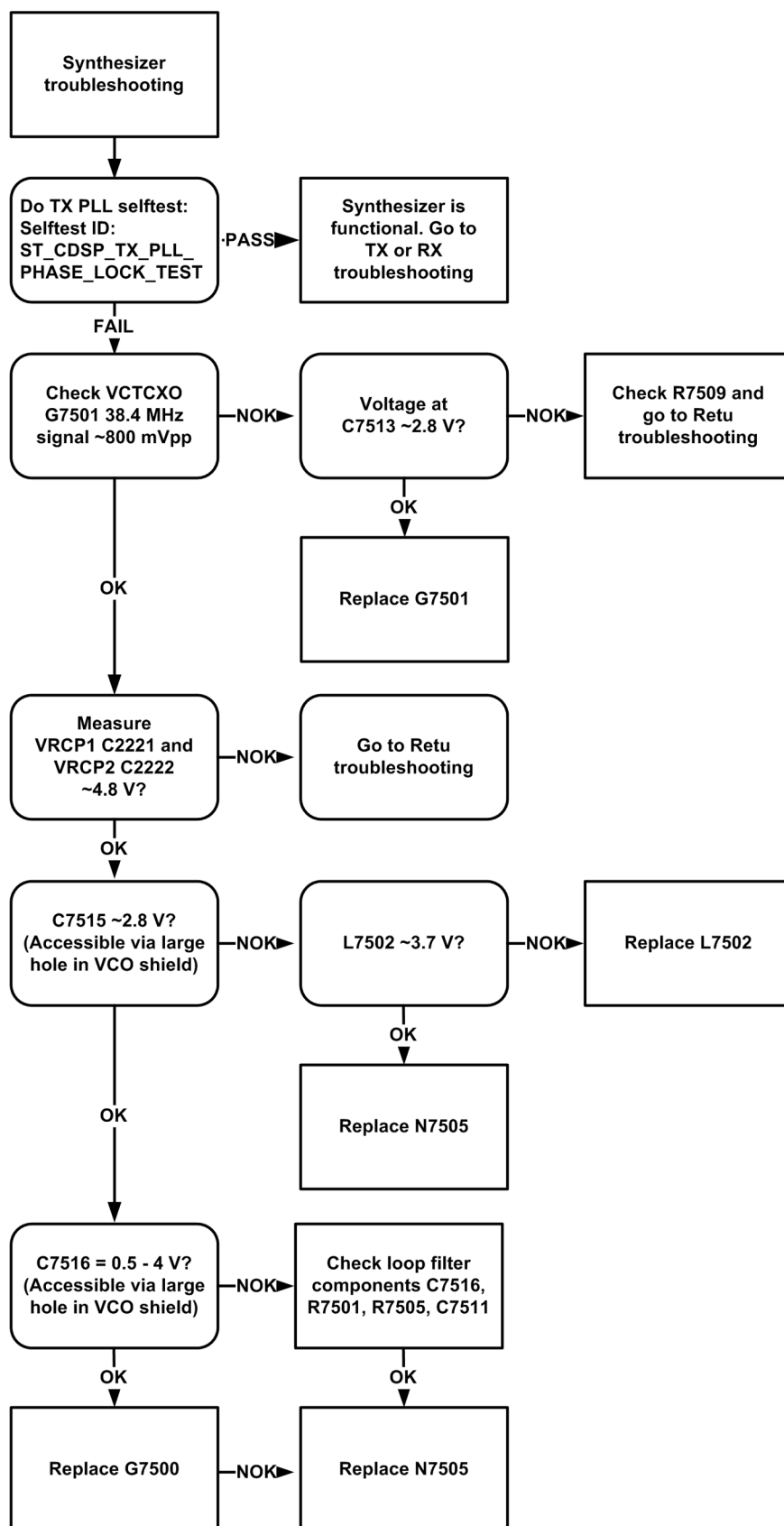


Figure 23 Antenna C-clips on the PWB

## ■ Synthesizer troubleshooting

### Synthesizer troubleshooting



## ■ RF tunings

### Introduction to RF tunings

**Important:** Only perform RF tunings if:

- one or more of the RF components have been replaced
- flash memory chip is replaced or corrupted.

RF calibration is always performed with the help of a product-specific module jig (MJ-122), never with an RF coupler. Using an RF coupler in the calibration phase will cause a complete mistuning of the RF part.

**Important:** After RF component replacements, **always** use autotuning. Manual tunings are only required in rare cases.

### Cable and adapter losses

RF cables and adapters have some losses. They have to be taken into account when the phone is tuned. As all RF losses are frequency dependent, the user has to act very carefully and understand the measurement setup.

For RF attenuations of the module jig, please refer to the Service tools section.

### Auto tuning for BB5.0

This phone can be tuned automatically.

Autotune is designed to align the phone's RF part easier and faster. It performs calibrations, tunings and measurements of RX and TX. The results are displayed and logged in a result file, if initiated.

### Hardware set up

Hardware requirements for auto tuning:

- PC (Windows 2000/XP) with GPIB card
- Power supply
- Product specific module jig
- Cables: XRF-1 (RF cable), USB cable, GBIP cable and DAU-9S
- Signal analyser (TX), signal generator (RX) and RF-splitter *or* one device including all.

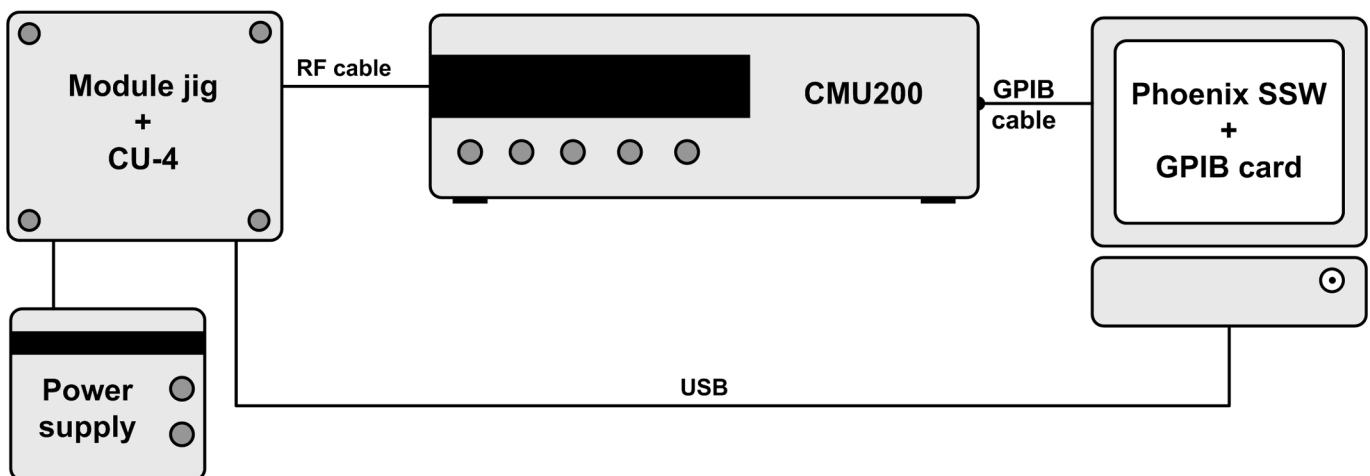


Figure 24 Auto tuning concept with CMU200

## Phoenix preparations

Install the phone specific data package, for example *RM-274\_DP20\_4.351\_sw-sk4.35[1].exe*. This defines phone specific settings..

## Auto tuning procedure

- 1 Make sure the phone (in the jig) is connected to the equipment. Else, some menus will not be shown in Phoenix.
- 2 To go to autotune, select *Tuning (Alt-U) > Auto-Tune (Alt-A)* from the menu.
- 3 Start autotuning, clicking the *Tune* button.

## ■ System mode independent manual tunings

### RF channel filter calibration

#### Context

Rf channel filter calibration tunes the internal low pass filters of the RF ASIC, that limit the bandwidth of BB IQ signals.

Table 9 Rf channel filter calibration tuning limits

	Min	Typ	Max
Tx filter	0	10	31
RX mixer	0	13	31
Rx filter	0	16	31

#### Steps

1. From the **Operating mode** drop-down menu, set mode to **Local**.
2. Choose **Tuning**→**Rf Channel Filter Calibration** .
3. Click **Tune**.
4. To save the values to the PMM (Phone Permanent Memory) area, click **Write**.
5. To close the *Rf Channel Filter Calibration* window, click **Close**.

#### Results

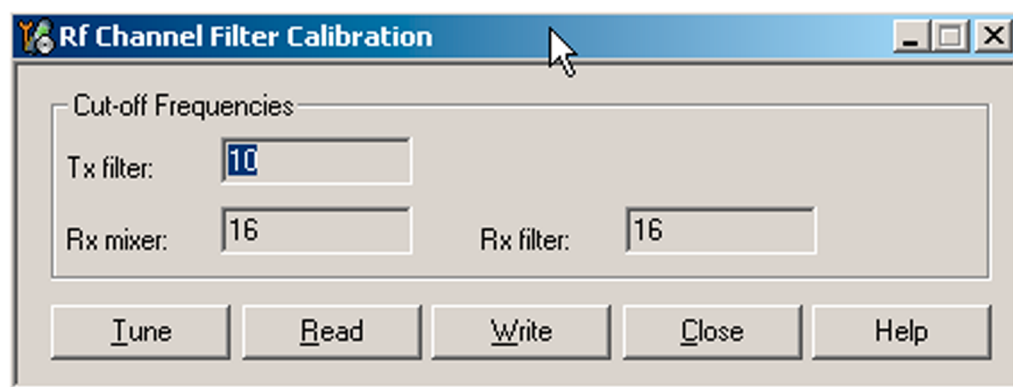


Figure 25 Rf channel filter calibration typical values

## PA (power amplifier) detection

### Context

The PA detection procedure detects which PA manufacturer is used for phone PAs.

If a PA is changed or if the permanent memory (PMM) data is corrupted, PA detection has to be performed before Tx tunings.

### Steps

1. From the **Operating mode** drop-down menu, set mode to **Local**.
2. Choose **Tuning**→**PA Detection**.
3. Click **Tune**.
4. Check that the detected PA manufacturers are corresponding to the actual chips on the board.
5. To end the procedure, click **Close**.

## ■ GSM receiver tunings

### Rx calibration (GSM)

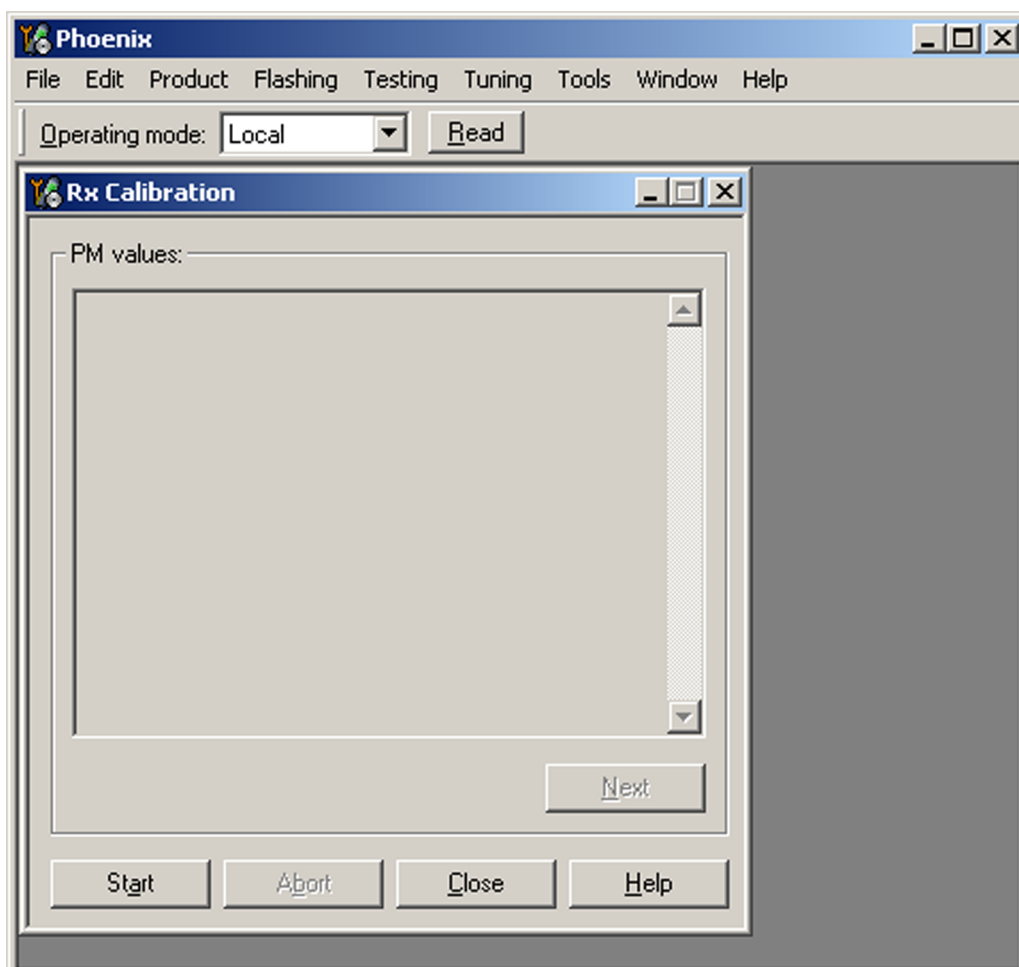
### Context

Rx Calibration is used to find out the real gain values of the GSM Rx AGC system and tuning response of the AFC system (AFC D/A init value and AFC slope)

### Steps

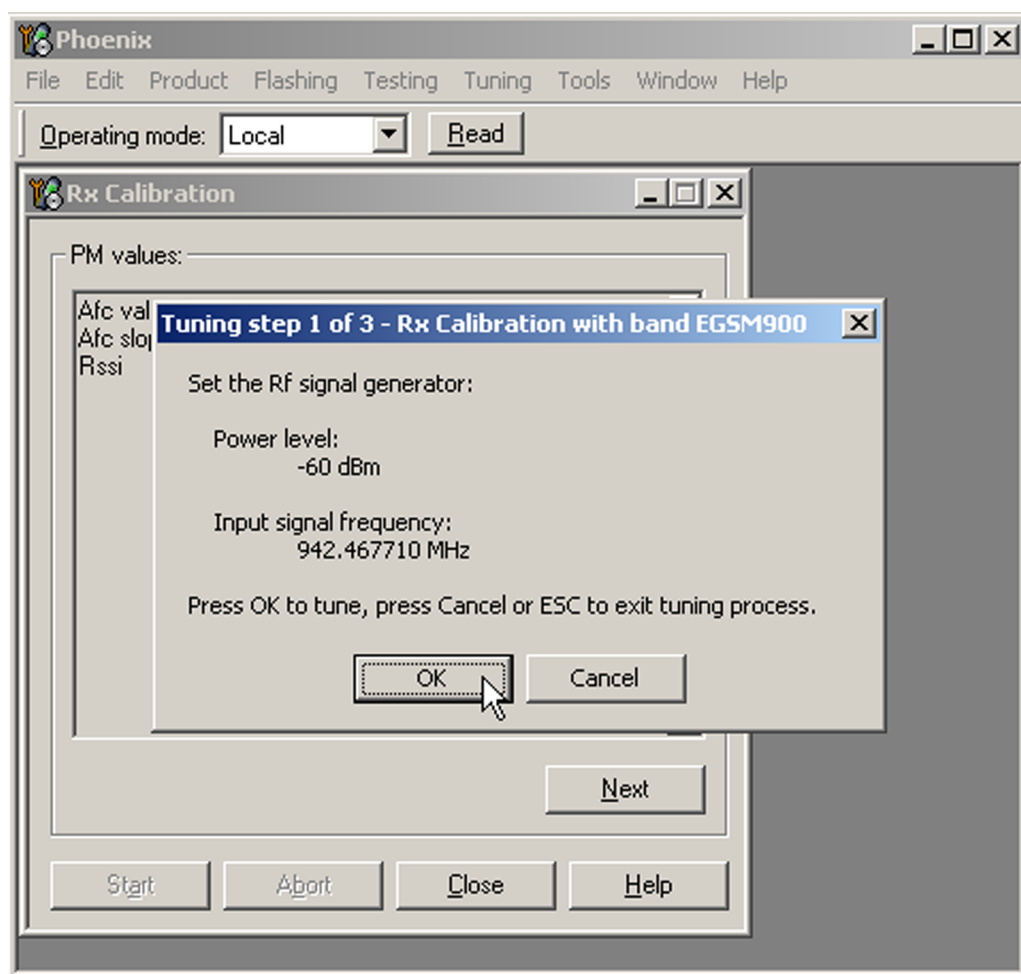
1. Connect the GSM connector of the module jig to a signal generator.
2. Start *Phoenix* service software.
3. From the **Operating mode** drop-down menu, set mode to **Local**.
4. Choose **Tuning**→**GSM**→**Rx Calibration**.

5. Click **Start**.



6. Connect the signal generator to the phone, and set frequency and amplitude as instructed in the **Rx Calibration with band EGSM900** (step 1-3) pop-up window.

**Important:** The calibration uses a non-modulated CW signal. Increase the signal generator level by cable attenuation and module jig probe attenuation.



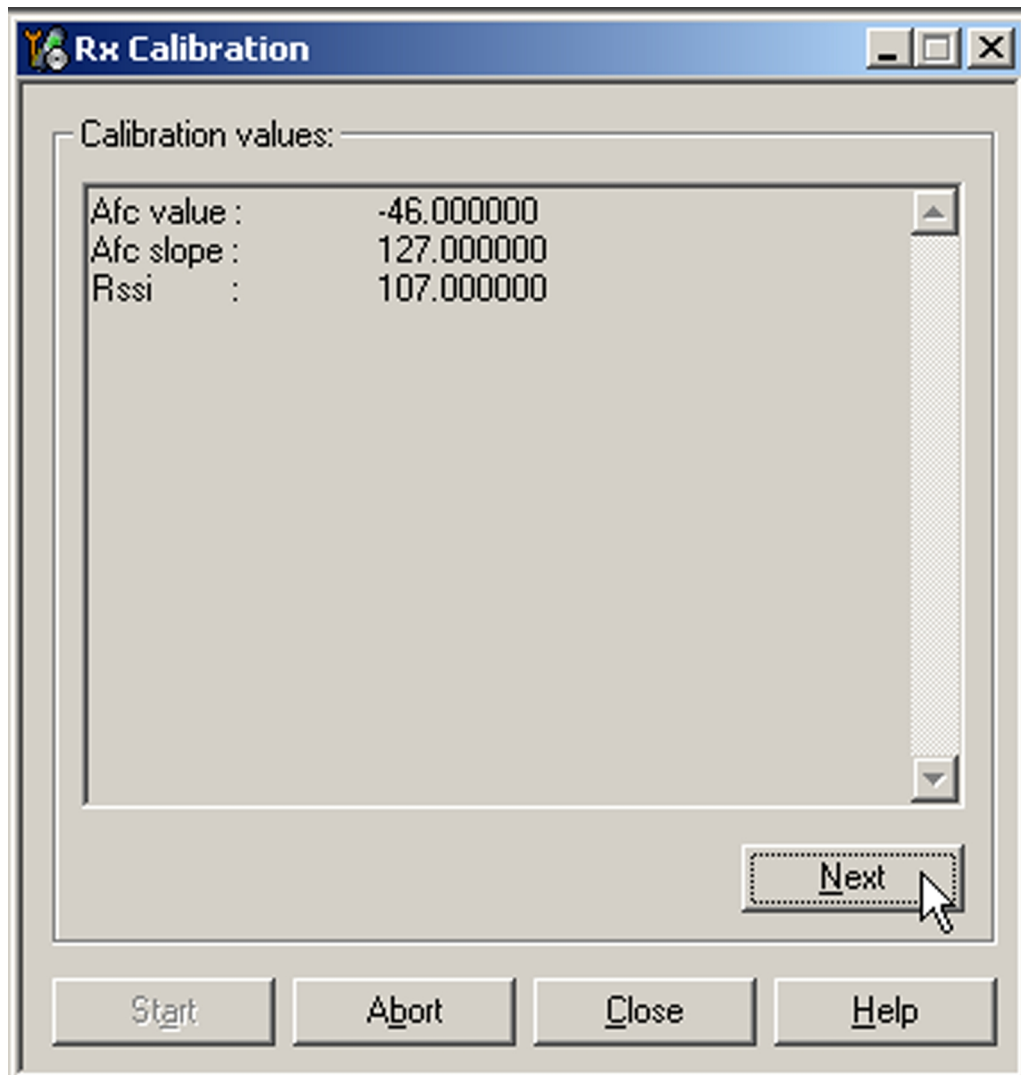
7. To perform the tuning, click **OK**.
8. Check that the tuning values are within the limits specified in the following table:

**Table 10 RF tuning limits in Rx calibration**

	Min	Typ	Max	Unit
<b>GSM900</b>				
AFC Value (init)	-200	-105..62	200	-
AFC slope	0	122	200	-
RSSI (AGC-0)	106	107...110	114	dB
<b>GSM1800</b>				
RSSI (AGC-0)	105	105...109	114	dB
<b>GSM1900</b>				
RSSI (AGC-0)	105	105...109	114	dB



9. Click **Next** to continue with GSM1800 Rx tuning.



### Next actions

Repeat steps 6 to 9 for GSM1800 and GSM1900

### Rx band filter response compensation (GSM)

#### Prerequisites

Rx calibration must be performed before the Rx band filter response compensation.

#### Context

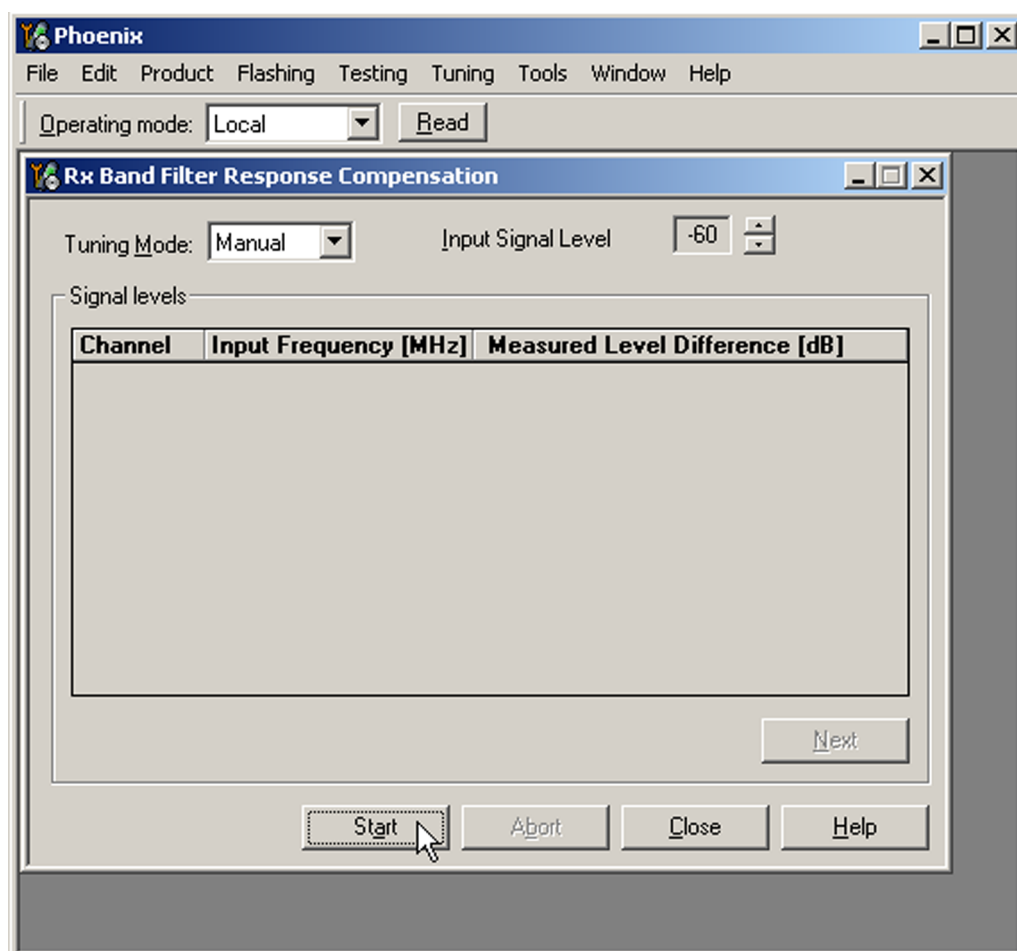
On each GSM Rx band, there is a band filter in front of the RF ASIC front end. The amplitude ripple caused by these filters causes ripple to the RSSI measurement, and therefore calibration is needed.

The calibration has to be repeated for each GSM band.

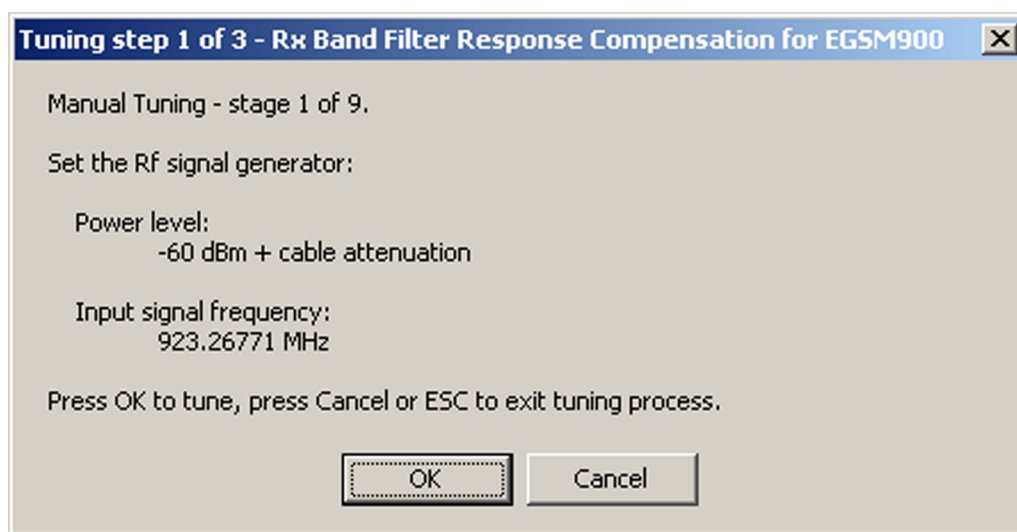
#### Steps

1. Connect the GSM connector of the module jig to a signal generator.
2. Start *Phoenix* service software.
3. From the **Operating mode** drop-down menu, set mode to **Local**.

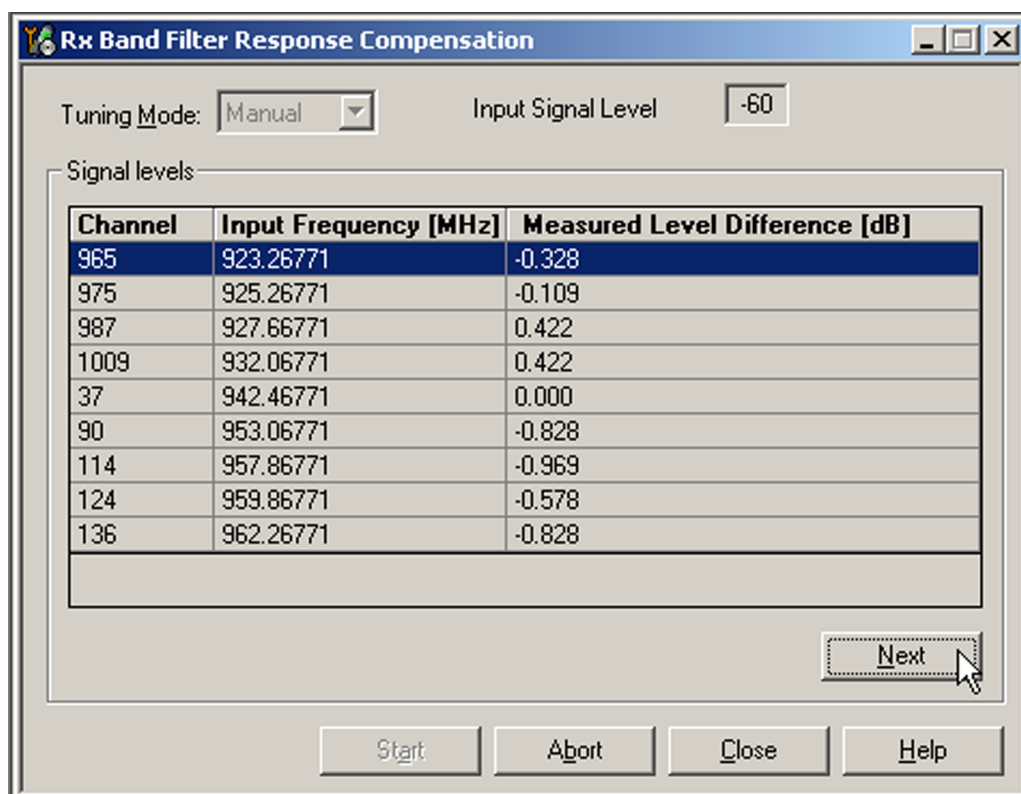
4. Select **GSM900** band.
5. Choose **Tuning**→**GSM**→**Rx Band Filter Response Compensation**.
6. Select **Tuning mode: manual**
7. Click **Start**.



8. Connect the signal generator to the phone, and set frequency and amplitude as instructed in the *Rx Band Filter Response Compensation for EGSM900* pop-up window, step 1-3.



9. To perform tuning, click **OK**.
10. Go through all 9 frequencies. The following table will be shown:



11. Check that the tuning values are within the limits specified in the following table:

	Min	Typ	Max	Unit
<b>GSM900</b>				
Ch. 965 / 923.26771 MHz	-6	-1	2	dB
Ch. 975 / 925.26771 MHz	-3	0	2	dB
Ch. 987 / 927.66771 MHz	-3	0	2	dB
Ch. 1009 / 932.06771 MHz	-2	0	2	dB
Ch. 37 / 942.46771 MHz	-2	0	2	dB
Ch. 90 / 953.06771 MHz	-2	0	2	dB
Ch. 114 / 957.86771 MHz	-3	0	2	dB
Ch. 124 / 959.86771 MHz	-3	0	2	dB
Ch. 136 / 962.26771 MHz	-6	-1	2	dB
<b>GSM1800</b>				
Ch. 497 / 1802.26771 MHz	-6	-1	3	dB
Ch. 512 / 1805.26771 MHz	-3	0	3	dB
Ch. 535 / 1809.86771 MHz	-3	0	3	dB
Ch. 606 / 1824.06771 MHz	-3	0	3	dB

	Min	Typ	Max	Unit
Ch. 700 / 1842.86771 MHz	-3	0	3	dB
Ch. 791 / 1861.06771 MHz	-3	0	3	dB
Ch. 870 / 1876.86771 MHz	-3	0	3	dB
Ch. 885 / 1879.86771 MHz	-3	0	3	dB
Ch. 908 / 1884.46771 MHz	-6	-1	3	dB
<b>GSM1900</b>				
Ch. 496 / 1927.06771 MHz	-6	-1	2	dB
Ch. 512 / 1930.26771 MHz	-3	0	2	dB
Ch. 537 / 1935.26771 MHz	-3	0	2	dB
Ch. 586 / 1945.06771 MHz	-3	0	2	dB
Ch. 661 / 1960.06771 MHz	-3	0	2	dB
Ch. 736 / 1975.06771 MHz	-3	0	2	dB
Ch. 794 / 1986.66771 MHz	-3	0	2	dB
Ch. 810 / 1989.86771 MHz	-3	0	2	dB
Ch. 835 / 1994.86771 MHz	-6	-1	2	dB

12. If the values are within the limits, click **Next** to continue to the next band.

## Next actions

Repeat the steps 8 to 12 for GSM1800 and GSM1900.

## ■ GSM transmitter tunings

### Tx IQ tuning (GSM)

#### Context

The Tx path branches to I and Q signals at RF I/Q modulator. Modulator and analog hardware located after it cause unequal amplitude and phase disturbance to I and Q signal paths. Tx IQ tuning balances the I and Q branches.

Tx IQ tuning must be performed for all GSM bands.

#### Steps

1. Start *Phoenix* service software.
2. From the **Operating mode** drop-down menu, set mode to **Local**.
3. Choose **Tuning**→**GSM**→**Tx IQ Tuning**.

4. Select **Mode: Automatic**.

**Tx IQ Selftuning**

Settings

Channel:  Power Level:

Tuning Values

Band	Dc Offset I	Dc Offset Q	Amplitude	Phase
GSM850/Edge	-0.144	-0.576	-0.1	89.00
GSM900/Edge	-0.144	-0.592	-0.1	89.00
GSM1800/Ed...	0.792	-0.180	0.1	94.00
GSM1900/Ed...	0.900	-0.160	0.1	93.00

5. Select band **GSM900** and click **Start**.
6. Click **Next** to start GSM1800 band TX IQ tuning.
7. Click **Next** to start GSM1900 band TX IQ tuning.
8. Click **Finish** and then **Close**.

### Next actions

Tuning sliders should be close to the center of the scale after the tuning and within the limits specified in the following table. If they are not within the limits, check Tx IQ quality manually.

	Min	Typ	Max	Unit
<b>GSM900</b>				
I DC offset / Q DC offset	-6	-4	6	%
Ampl	-1	0	1	dB
Phase	85	90	95	°
<b>GSM1800/GSM1900</b>				
I/Q DC	-6	0.5	6	%
Ampl	-1	0	1	dB
Phase	95	100	110	°

## Tx power level tuning (GSM)

### Context

Because of variations at the IC (Integrated Circuit) process and discrete component values, the actual transmitter RF gain of each phone is different. Tx power level tuning is used to find out mapping factors called 'power coefficients'. These adjust the GSM transmitter output power to fulfill the specifications.

For EDGE transmission, the bias settings of the GSM PA are adjusted in order to improve linearity. This affects the PA gain and hence the power levels have to be aligned separately for EDGE transmission.

Tx power level tuning has to be performed on all GSM bands.

### Steps

1. Connect the phone to a spectrum analyzer.
2. Start *Phoenix* service software.
3. From the **Operating mode** drop-down menu, set mode to **Local**.
4. Choose **Tuning→GSM→Tx Power Level Tuning**.

5. Click **Start**.

**Tx Power Level Tuning**

Settings

Band: **GSM 900** Freq. [MHz]: **897.40**

Power Levels

Power Level	Value	Target	DAC
14 Coeff.	0.2830	15.0	290
15 Coeff.	0.2656	13.0	272
<b>16 Coeff.</b>	<b>0.2516</b>	<b>11.0</b>	<b>258</b>
17 Coeff.	0.2386	9.0	244
18 Coeff.	0.2280	7.0	233
<b>19 Coeff.</b>	<b>0.2166</b>	<b>5.0</b>	<b>222</b>
Base Coeff.	0.0869		89
2SlotThreshold	7.0000		7168
2SlotCoefficient	0.5596	30.5	573
3SlotThreshold	7.0000		7168
3SlotCoefficient	0.5596	30.5	573
4SlotThreshold	7.0000		7168
4SlotCoefficient	0.5596	30.5	573

Read Next

Start Finish Close Help

6. Set the spectrum analyzer for power level tuning:

Frequency	Channel frequency: <ul style="list-style-type: none"> <li>• <b>897.4MHz GSM900</b></li> <li>• <b>1747.8MHz GSM1800</b></li> <li>• <b>1880MHz GSM1900</b></li> </ul>
Span	0 Hz
Sweep time	2ms
Trigger	Video triggering (-10dBm)
Resolution BW	3MHz

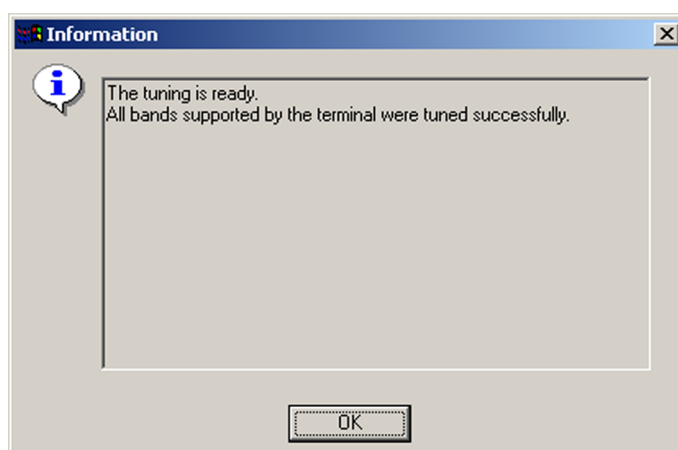
Video BW	3MHz
Reference level offset	sum cable attenuation with module jig attenuation
Reference level	33dBm

A power meter with a peak power detector can be also used. Remember to take the attenuations into account.

7. Adjust power for all bold power levels to correspond the **Target dBm** column by pressing + or – keys.
8. If all bold power levels are adjusted, click **Next** to continue with **GSM900 EDGE**.
9. Adjust power for all bold power levels to correspond the **Target dBm** column by pressing + or – keys.

### Next actions

Continue tuning the bold power levels of the GSM1800 and GSM1900 bands. You will see this message, if finished successfully:





## 5 — System module

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## ■ Phone description

### Introduction

This chapter describes the system module including engine, power management, interfaces, audio etc. The baseband is based on BB5.0 with a RAPGSM main processor and Retu/Tahvo energy management. All blocks that require high voltage process are in Tahvo and all other in Retu. The RF part is based on the ASIC Ahne.

RM-274 is a monoblock phone, in which all electrical components are assembled into one PWB.

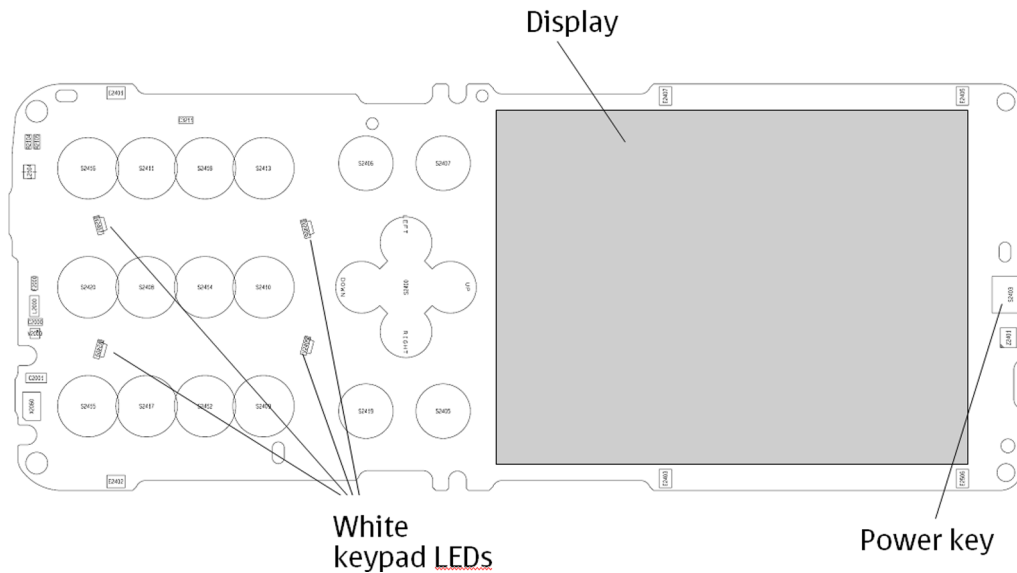
RM-274 operates on the GSM 900/1800/1900 bands.

### Key components

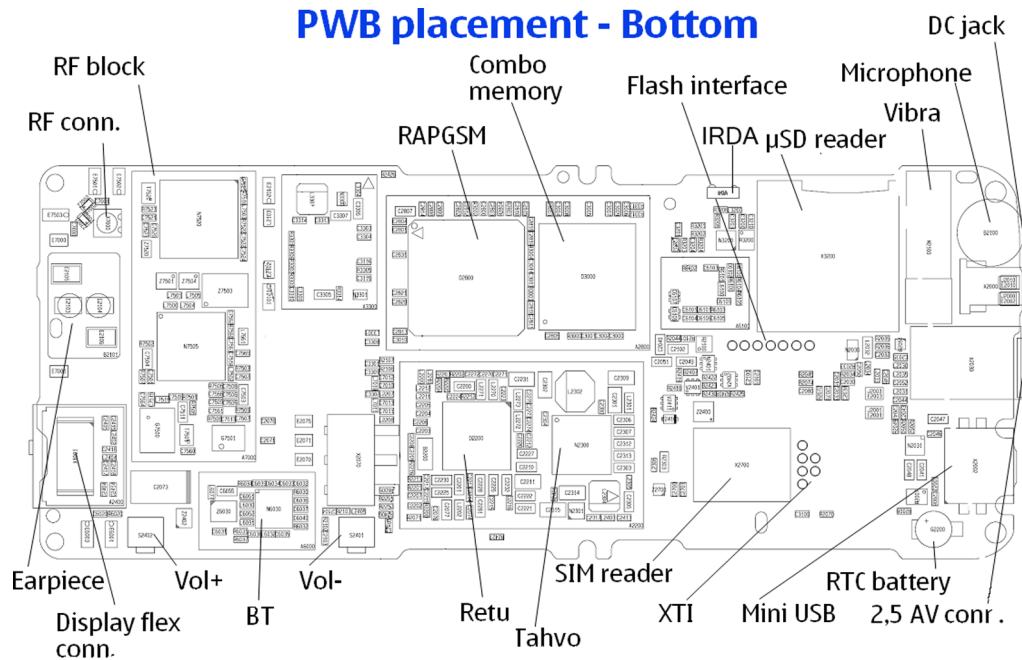
Function	Name	Item
Energy management	Retu	D2200
	Tahvo	N2300
Main processor	RAPGSM	D2800
Memory	Combo: 128 Mbit SDRAM & 256 Mbit NOR flash	D3000
RF ASIC	Ahne	N7505
Front end module	Power amplifier and Antenna Switch	N7520
Antenna	Antenna module assembly RM-274: 900/1800/1900MHz	
System connector	AV connector	X2030
	mini USB connector	X2002
Battery	BL-5C, 3.7 V, 860 mAh	
Bluetooth	BC4-ROM	N6030
IHF Speaker	Donau or Aura (in antenna module assembly)	
Earpiece	RDF-07A 320HM 10.86x7.40.2.2	B2101
Microphone	Clapton	B2100
Vibra	SMD VIBRA MOTOR	M2100
Charger connector	2 mm Nokia charger interface	X2000
HWA	STV0984N	D3300
Display	SEID or AU0 128X160	
LED driver	TPS 61061 YZFR	N2301
RTC battery	311 size	G2200

## PWB overview

### PWB placement - Top



### PWB placement - Bottom



## System block diagram

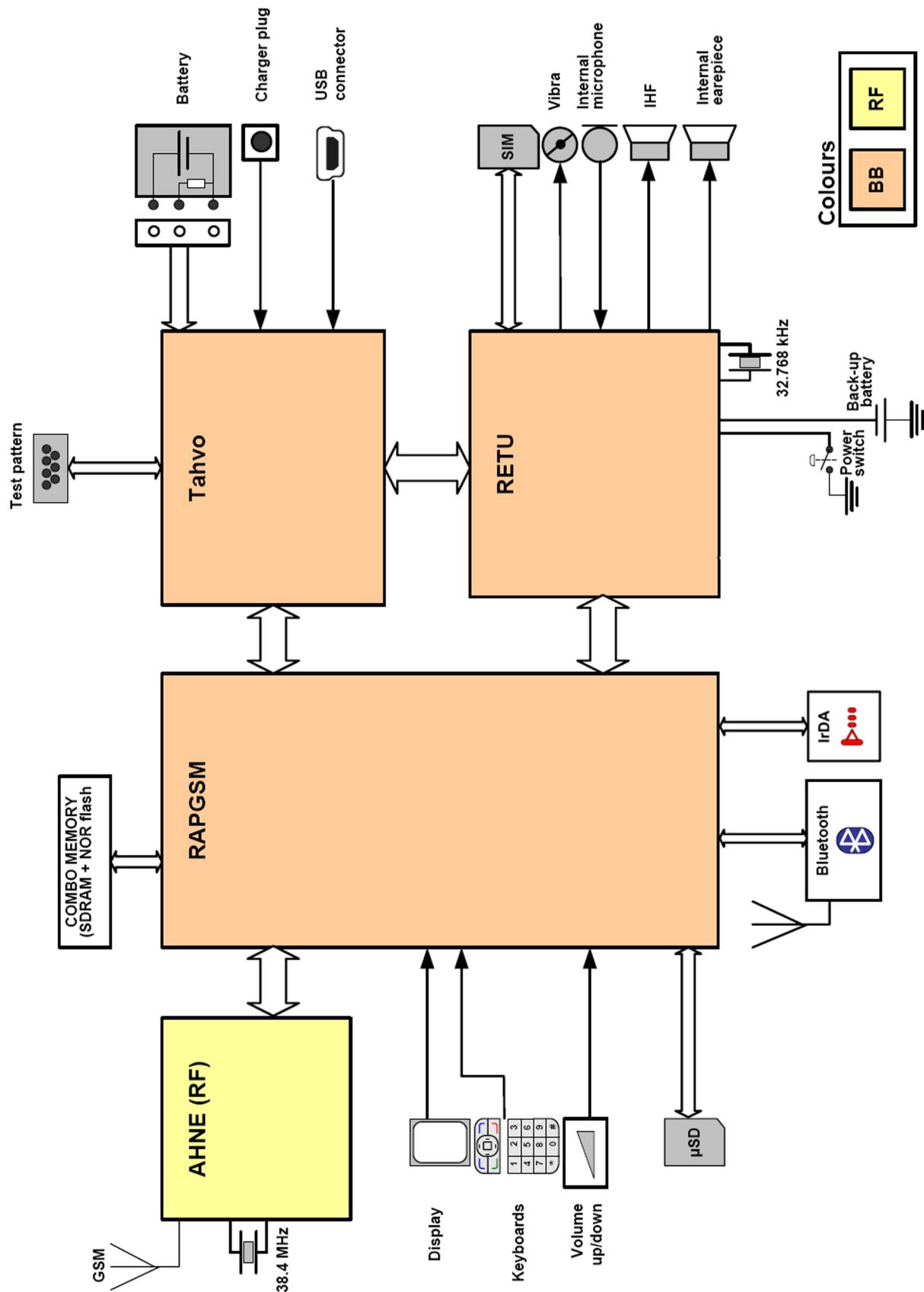


Figure 26 System block diagram

## Board and module connections

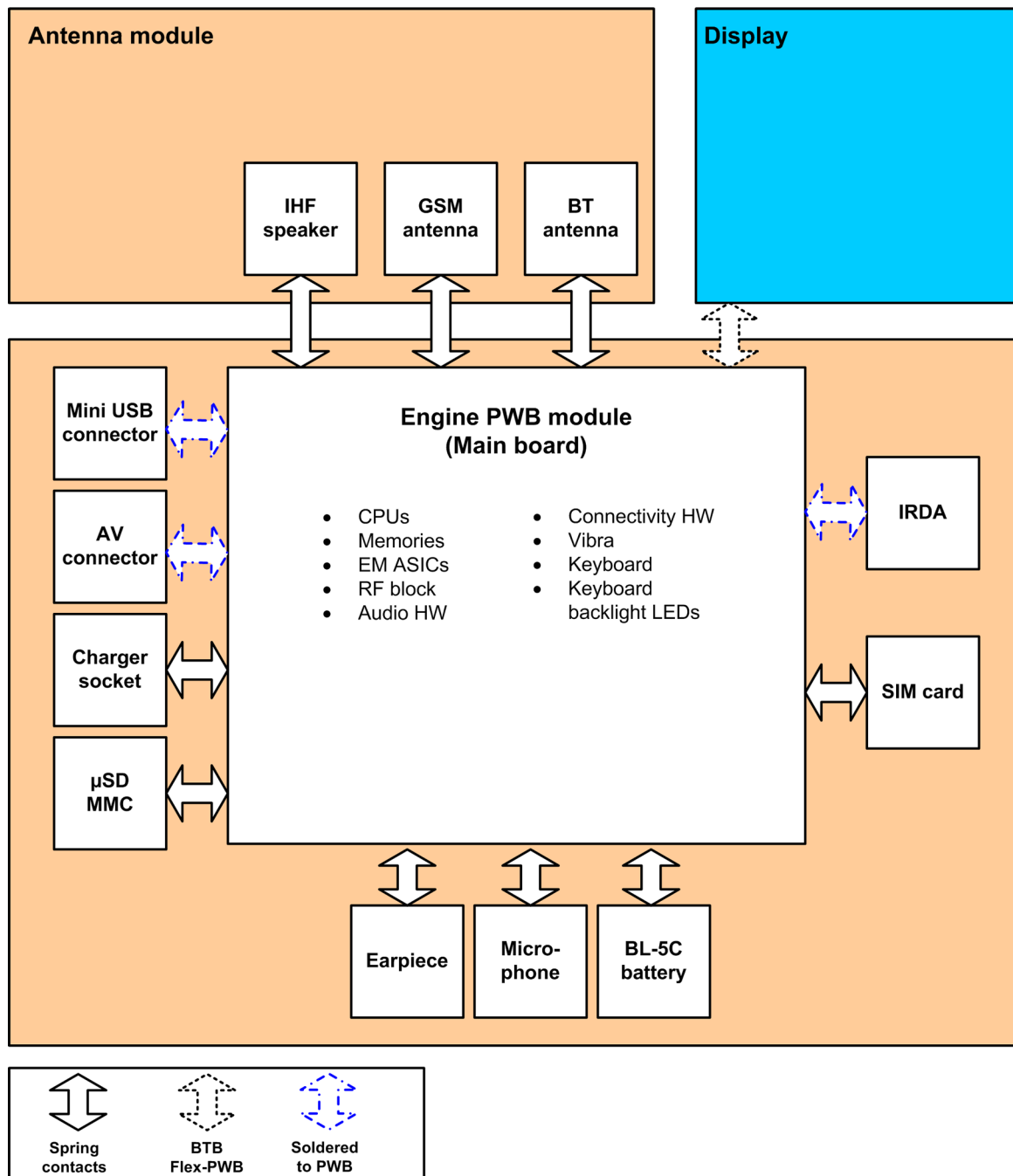


Figure 27 Board and module connections

## ■ Engine

### Engine modules

The engine contains

- RF module with Ahne ASIC
- Main processor with integrated memory (Baseband)
- Energy management - Retu and Tahvo (Baseband)



- SDRAM and NOR flash memories

## RF engine

The RF module performs the high frequency operations of the engine for GSM. In both transmitter and receiver, the modulator and demodulator operate at the channel frequency.

The core components of the RF module are:

- Ahne RF ASIC (application specific integrated circuit)
- Front end module (FEM) module (Power amplifier and Antenna switch)

The RF engine also includes:

- Voltage controlled oscillators (VCO and VCTCX0)
- SAW filters

The baseband section controls the RF module through the serial bus, RFBUS. This passes information about eg. frequency band and mode of operation. Ahne RF ASIC controls the mode of operation, and further sends control signals to the front end module.

In addition to the RFBUS there are other interface signals for the power control loop, VCTCX0 control and for the modulated waveforms.

## Main processor

The main processor in this device is RAPGSM, a BB5.0 ASIC.

Some of its interfaces, processors and controllers are:

- General purpose UARTs
- Processor modules
- I2C (between ICs) interface
- GSM coder
- Interfaces to user interface, SIM and MMC
- Accessory interface
- Handling of RF-BB interface
- I/O voltage = 1.8 V, Core voltage <1.8 V

## Energy management

Two ASICs manage the energy in the phone; Retu and Tahvo. Together they cover the analogue audio and energy management function needs.

### Tahvo

All blocks that need a special silicon process are included in Tahvo.

Tahvo's main features are:

- Energy management control
- Supply voltage generation
- Charge control
- Digital core supply
- Current control for LED supply

### Retu

The blocks that do not have special needs are included in Retu.

Retu controls for example:

- Audio block
- SIM
- FM radio

## Modes of operation

The functional behavior can be divided into seven different states. Each of these states will affect the general functionality of the phone:

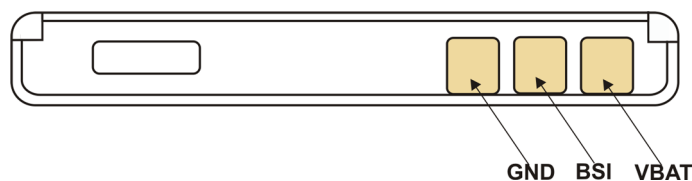
- No supply
- Backup
- Power off
- Reset
- Power on
- Deep sleep

## ■ Battery and charging

### Battery

- Type: BL-5C, Li-Ion
- Capacity: 1020mAh
- BSI resistor nominal value: 75 k $\Omega$

Battery temperature is measured on the NTC on the main board.



### Battery connector

The battery connector has three poles:

- BSI (Battery size indicator)
- GND (Ground)
- VBAT (Battery voltage)

The BSI line is used to recognize the battery capacity by a battery internal pull down resistor.

### Charging

This phone is charged through the smaller Nokia standard interface (2.0 mm plug). The old standard charger (3.5 mm) can be used together with the CA-44 charger adapter.



Figure 28 Old (left) and new (right) charger plugs

Charging is controlled by energy management, and external components are needed to protect the baseband module against EMC, reverse polarity and transient frequency deviation.

## ■ Interfaces

### SIM

The SIM interface is the electrical interface between the SIM card and the mobile phone engine.

The data communication between the SIM card and the phone is asynchronous half duplex.

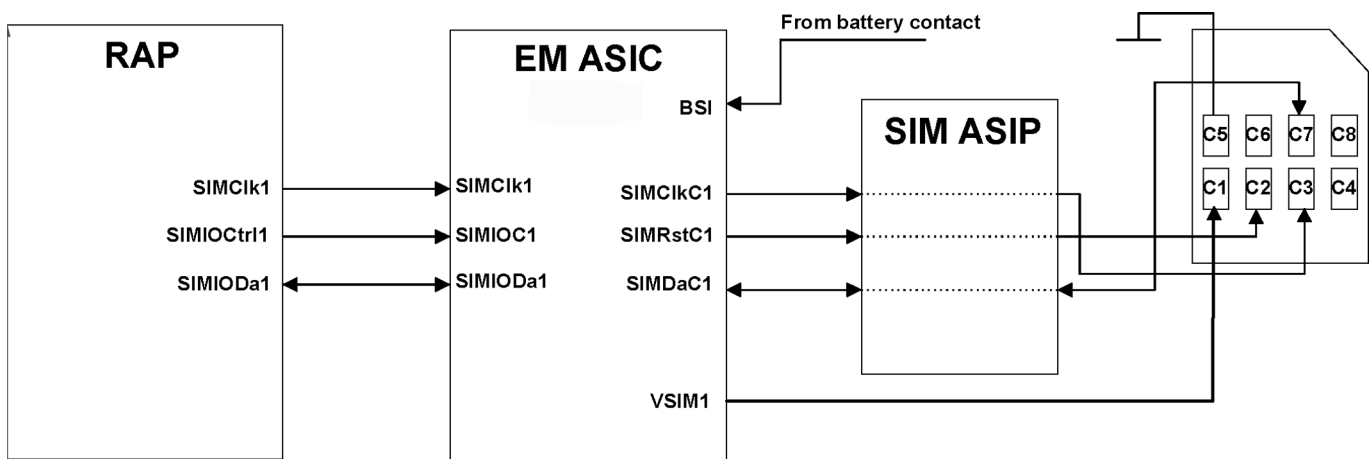


Figure 29 SIM interface connections

### SIM Logic level shifting

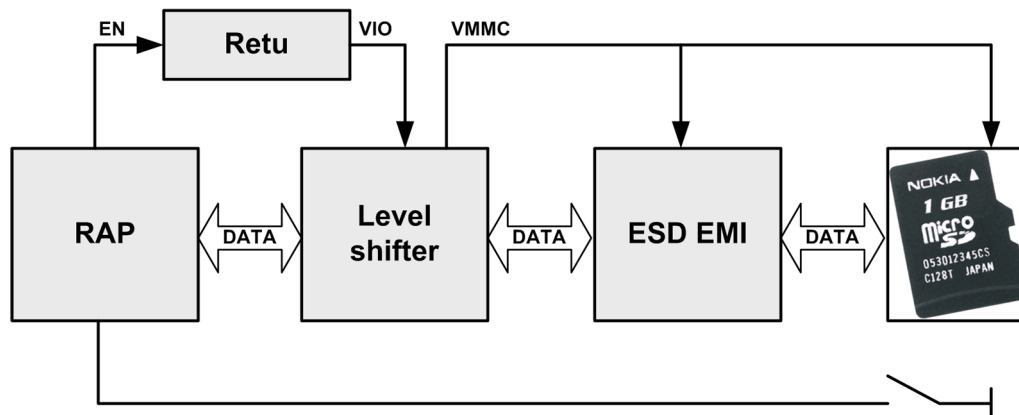
The SIM interface can support 3V and 1.8V SIM cards.

### SIM Power up/down

The SIM power up/down sequence is generated in Retu. This means that Retu generates the reset switch (RST) signal to the SIM. In addition, the SIMCardDet signal is connected to Retu.

The SIM interface is powered up when the SIMCardDet signal indicates "card in".

## µSD card interface



The µSD card is connected to the engine by an external level shifter and ESD protection filter. Supplied voltages:

- VMMC: 2.85 V (from level shifter)
- VIO: 1.8 V (from Retu)

The card removal is detected by a push detect switch.

## User interface

### Display

The display unit comprises a parallel interface.

### Keyboard

All keys are placed on the main PWB.

- Numeric keys
- Navigation key, Soft keys, Start, and End
- Power switch
- Volume up and down switch

### Display and keypad backlight

There are two sets of LEDs illuminating the display and the keypads:

- Display LEDs, 4pcs
- Main keypad on PWB, 4 pcs, white colour

All sets share the same driver. None of the keypads can be illuminated without the LCD backlight being turned on.

## Audio concept

### Audio concept

The functional core of the audio hardware is built around two ASICs; RAP engine and Retu.

Retu provides an interface for the transducers and the AV connector.

There are three audio transducers:

- 1 dynamic earpiece

- 1 dynamic speaker
- 1 microphone module

Retu also provides an output for the vibra motor.

All external audio accessories are connected to the specific audio connector.

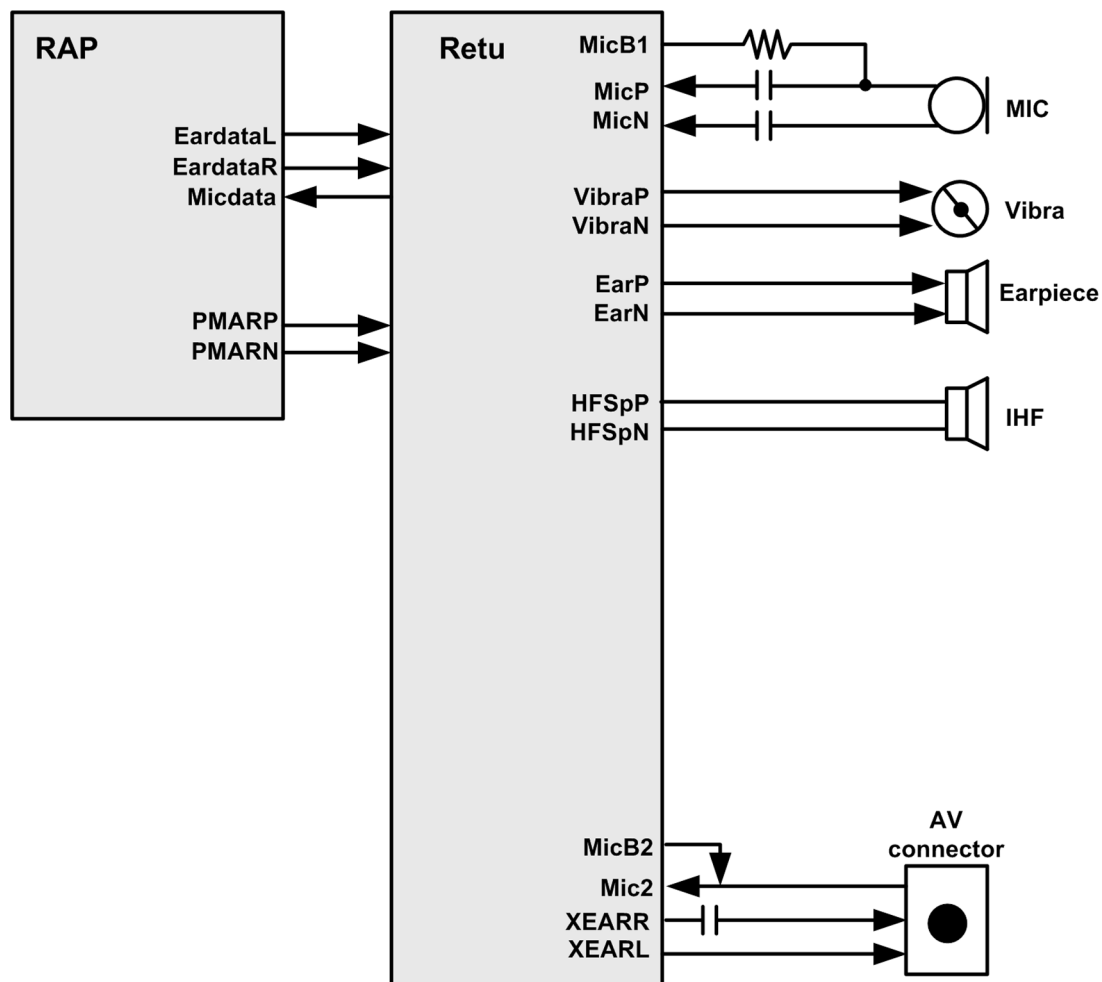


Figure 30 Audio block diagram

## Internal audio

The internal audio components are used in these modes:

	Hand portable (HP) mode	Internal hands free (IHF) mode
Microphone	X	X
Earpiece	X	
Speaker		X

## ■ Connections

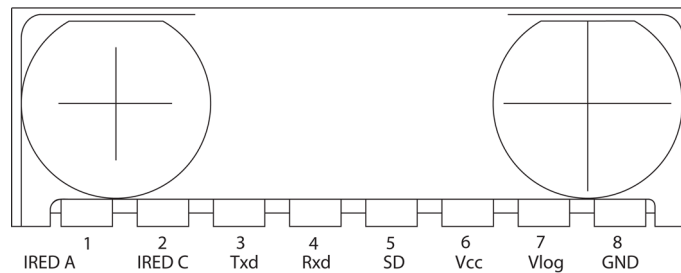
### IrDA

IrDA is a fully digital peer-to-peer data link between IrDA units. The link is based on the serial transmission of data as pulses of infrared light. The IrDA module contains both RX part and TX part.

The IrDA interface is integrated in RAPGSM.

Datarate: 1.152 Mbit

Max. operating distance: 1 m



**Figure 31 IR module pin ordering**

## AV connector

Headsets and other galvanic accessories are connected to the specific audio input. The accessory mode is automatically enabled/disabled when a dedicated accessory is connected/disconnected.

**Note:** When testing external audio through the audio connector, make sure that the specific accessory can be used with this phone!

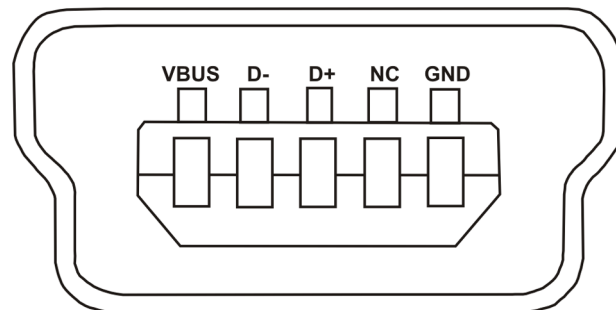
## USB

USB (Universal Serial Bus) provides a wired connectivity between a PC and peripheral devices. It is a differential serial bus.

USB 2.0 is supported with full speed (12 Mbps).

Hot swap is supported, which means that USB devices may be plugged in/out at any time.

This phone is provided with a specific connector for mini USB.



## Bluetooth

Bluetooth provides a fully digital link for communication between a master unit and one or more slave units.

This bluetooth solution is a single chip solution.

Bluetooth connects to RAPGSM on the GENIO and GPIO busses.

The Bluetooth module is provided with power from VBat.

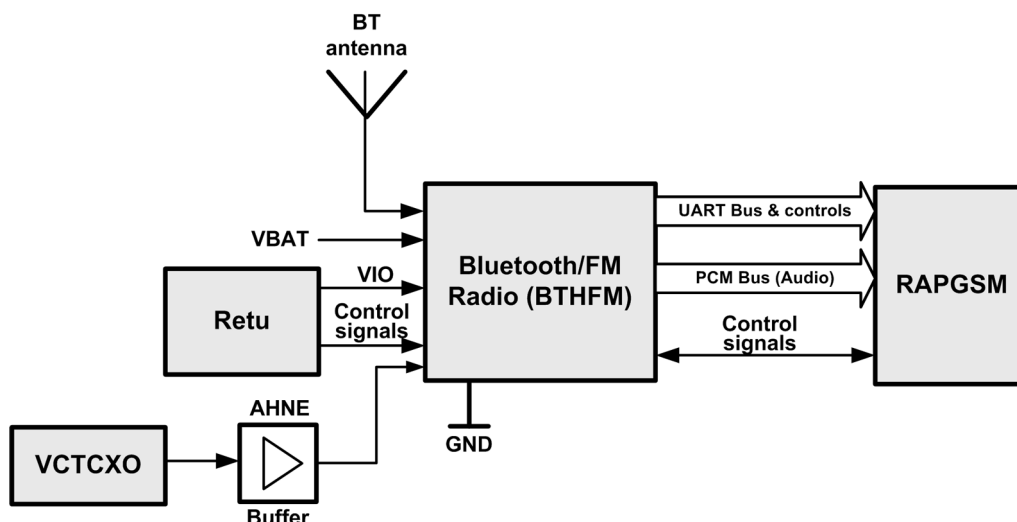


Figure 32 Bluetooth interface block diagram

## ■ Main RF characteristics

Table 11 Channel numbers and frequencies

System	Channel number	TX frequency	RX frequency	Unit
GSM900	$0 \leq n \leq 124$	$F = 890 + 0.2 \cdot n$	$F = 935 + 0.2 \cdot n$	MHz
	$975 \leq n \leq 1023$	$F = 890 + 0.2 \cdot (n - 1024)$	$F = 935 + 0.2 \cdot (n - 1024)$	MHz
GSM1800	$512 \leq n \leq 885$	$F = 1710.2 + 0.2 \cdot (n - 512)$	$F = 1805.2 + 0.2 \cdot (n - 512)$	MHz
GSM1900	$512 \leq n \leq 810$	$F = 1850.2 + 0.2 \cdot (n - 512)$	$F = 1930.2 + 0.2 \cdot (n - 512)$	MHz

Table 12 Main RF characteristics

Parameter	Unit and value
Cellular systems	EGSM900/GSM1800/GSM1900
RX Frequency range	EGSM900: 925 ... 960 MHz
	GSM1800: 1805...1880 MHz
	GSM1900: 1930...1990 MHz
TX Frequency range	EGSM900: 880 ... 915 MHz
	GSM1800: 1710 ...1785 MHz
	GSM1900: 1850...1910 MHz
Duplex spacing	EGSM900: 45 MHz
	GSM1800: 95 MHz
	GSM1900: 80 MHz
Channel spacing	200 kHz

Parameter	Unit and value
Number of RF channels	EGSM900: 174
	GSM1800: 374
	GSM1900: 300
Output Power	EGSM900: GSMK 5...32.5 dBm
	EGSM900: 8-PSK 5...26.5 dBm
	GSM1800: GSMK 0...30.5 dBm
	GSM1800: 8-PSK 0...25.5 dBm
	GSM1900: GSMK 0...30.5 dBm
	GSM1900: 8-PSK 0...25.5 dBm
Number of power levels GSMK	EGSM900: 15
	GSM1800: 16
	GSM1900: 16
Number of power levels 8-PSK	EGSM900: 12
	GSM1800: 14
	GSM1900: 14

**Table 13 Transmitter characteristics**

Item	Values
Type	Direct conversion, nonlinear, FDMA/TDMA
LO frequency range	EGSM900: 3520...3660 MHz (4 x TX freq)
	GSM1800: 3420...3570 MHz (2 x TX freq)
	GSM1900: 3700...3820 MHz (2 x TX freq)
Output power (EGSM900/GSM1800/GSM1900)	GSMK 33/33/30/30 dBm 8-PSK 32.5/30.5/30.5 dBm
Gain control range	min. 30 dB
Phase error (RMS/peak), GSMK	5 deg./20 deg. peak
EVM (RMS/peak), 8-PSK	10%/30%

**Table 14 Receiver characteristics**

Item	Values
Type	Direct conversion, Linear, FDMA/TDMA
LO frequencies	EGSM900: 3700...3840 MHz (4 x RX freq)
	GSM1800: 3610...3760 MHz (2 x RX freq)
	GSM1900: 3860...3980 MHz (2 x RX freq)
Typical 3 dB bandwidth	+/- 91 kHz



Item	Values
Sensitivity	min. - 102 dBm (normal condition)
Total typical receiver voltage gain (from antenna to RX ADC)	86 dB
Receiver output level (RF level -95 dBm)	40 mVpp, single-ended I/Q signals to RX ADCs

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# Nokia Customer Care

## Glossary

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A/D-converter	Analog-to-digital converter
ACI	Accessory Control Interface
ADC	Analog-to-digital converter
ADSP	Application DPS (expected to run high level tasks)
AGC	Automatic gain control (maintains volume)
ALS	Ambient light sensor
AMSL	After Market Service Leader
ARM	Advanced RISC Machines
ARPU	Average revenue per user (per month or per year)
ASIC	Application Specific Integrated Circuit
ASIP	Application Specific Interface Protector
B2B	Board to board, connector between PWB and UI board
BB	Baseband
BC02	Bluetooth module made by CSR
BIQUAD	Bi-quadratic ,type of filter function)
BSI	Battery Size Indicator
BT	Bluetooth
CBus	MCU controlled serial bus connected to UPP_WD2,UEME and Zocus
CCP	Compact Camera Port
CDSP	Cellular DSP (expected to run at low levels)
CLDC	Connected limited device configuration
CMOS	Complimentary metal-oxide semiconductor circuit (low power consumption)
COF	Chip on Foil
COG	Chip on Glass
CPU	Central Processing Unit
CSR	cambridge silicon radio
CSTN	Color Super Twisted Nematic
CTSI	Clock Timing Sleep and interrupt block of Tiku
CW	Continuous wave
D/A-converter	Digital-to-analogue converter
DAC	Digital-to-analogue converter
DBI	Digital Battery Interface
DBus	DSP controlled serial bus connected between UPP_WD2 and Helgo
DCT-4	Digital Core Technology
DMA	Direct memory access
DP	Data Package

DPLL	Digital Phase Locked Loop
DSP	Digital Signal Processor
DtoS	Differential to Single ended
EDGE	Enhanced data rates for global/GSM evaluation
EGSM	Extended GSM
EM	Energy management
EMC	Electromagnetic compability
EMI	Electromagnetic interference
ESD	Electrostatic discharge
FCI	Functional cover interface
FPS	Flash Programming Tool
FR	Full rate
FSTN	Film compensated super twisted nematic
GMSK	Gaussian Minimum Shift Keying
GND	Ground, conductive mass
GPIO	General-purpose interface bus
GPRS	General Packet Radio Service
GSM	Group Special Mobile/Global System for Mobile communication
HF	Hands free
HFCM	Handsfree Common
HS	Handset
HSCSD	High speed circuit switched data (data transmission connection faster than GSM)
HW	Hardware
I/O	Input/Output
IBAT	Battery current
IC	Integrated circuit
ICHAR	Charger current
IF	Interface
IHF	Integrated hands free
IMEI	International Mobile Equipment Identity
IR	Infrared
IrDA	Infrared Data Association
ISA	Intelligent software architecture
JPEG/JPG	Joint Photographic Experts Group
LCD	Liquid Crystal Display
LDO	Low Drop Out

LED	Light-emitting diode
LPRF	Low Power Radio Frequency
MCU	Micro Controller Unit (microprocessor)
MCU	Multiport control unit
MIC, mic	Microphone
MIDP	Mobile Information Device Profile
MIN	Mobile identification number
MIPS	Million instructions per second
MMC	Multimedia card
MMS	Multimedia messaging service
NTC	Negative temperature coefficient, temperature sensitive resistor used as a temperature sensor
OMA	Object management architecture
OMAP	Operations, maintenance, and administration part
Opamp	Operational Amplifier
PA	Power amplifier
PDA	Pocket Data Application
PDA	Personal digital assistant
PDRAM	Program/Data RAM (on chip in Tiku)
Phoenix	Software tool of DCT4.x
PIM	Personal Information Management
PLL	Phase locked loop
PM	(Phone) Permanent memory
PUP	General Purpose IO (PIO), USARTS and Pulse Width Modulators
PURX	Power-up reset
PWB	Printed Wiring Board
PWM	Pulse width modulation
RC-filter	Resistance-Capacitance filter
RF	Radio Frequency
RF PopPort TM	Reduced function PopPortTM interface
RFBUS	Serial control Bus For RF
RSK	Right Soft Key
RS-MMC	Reduced size Multi Media Card
RSSI	Receiving signal strength indicator
RST	Reset Switch
RTC	Real Time Clock (provides date and time)

RX	Radio Receiver
SARAM	Single Access RAM
SAW filter	Surface Acoustic Wave filter
SDRAM	Synchronous Dynamic Random Access Memory
SID	Security ID
SIM	Subscriber Identity Module
SMPS	Switched Mode Power Supply
SNR	Signal-to-noise ratio
SPR	Standard Product requirements
SRAM	Static random access memory
STI	Serial Trace Interface
SW	Software
SWIM	Subscriber/Wallet Identification Module
TCXO	Temperature controlled Oscillator
Tiku	Finnish for Chip, Successor of the UPP
TX	Radio Transmitter
UART	Universal asynchronous receiver/transmitter
UEME	Universal Energy Management chip (Enhanced version)
UEMEK	See UEME
UI	User Interface
UPP	Universal Phone Processor
UPP_WD2	Communicator version of DCT4 system ASIC
USB	Universal Serial Bus
VBAT	Battery voltage
VCHAR	Charger voltage
VCO	Voltage controlled oscillator
VCTCXO	Voltage Controlled Temperature Compensated Crystal Oscillator
VCXO	Voltage Controlled Crystal Oscillator
Vp-p	Peak-to-peak voltage
VSIM	SIM voltage
WAP	Wireless application protocol
WD	Watchdog
XHTML	Extensible hypertext markup language
Zocus	Current sensor, (used to monitor the current flow to and from the battery)